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ENGINEERING AND MINING JOURNAL

A Consolidation of Engineering and Mining Journal and Mining and Scientific Press

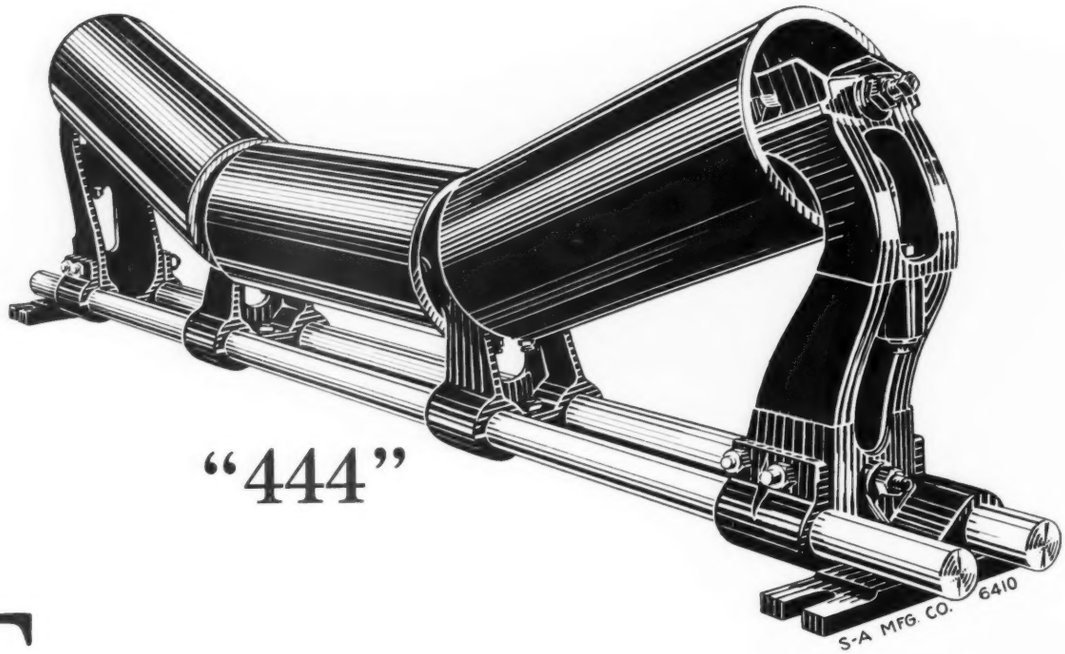
METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

Birmingham—The Mining Center of the South
By Albert H. Fay

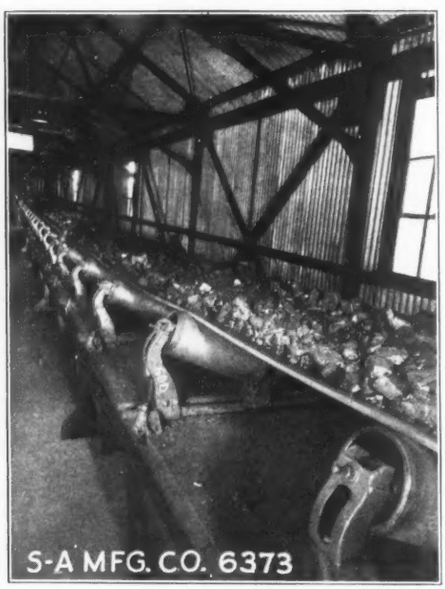
On Ore Magmas-II
By Prof. J. H. L. Vogt

The Myth of Eldorado
By T. A. Rickard

Mining Osmiridium in Tasmania
By Percy O. Lennon



This Carrier can be tipped without stopping the belt



If a conveyor carrier is to be inspected, adjusted or removed, with the ordinary carrier conveyor, it simply means stopping the whole belt until the job is done. If the belt is a large one and doing important work, delays like this can easily become an expensive item.

Supplying the answer to *this* need is just one of the superior features of the S-A "444" Carrier shown above. This carrier is pivoted on a shaft, permitting the troughing carrier to be tipped out of operating position while the conveyor belt is in operation.

Positive high pressure lubrication; high grade ball bearings in dust-tight, self-aligning housings; low power consumption,—are some other features. The illustration shows the S-A "444" in use in the longest belt conveyor installation in the world.

Write for Bulletin No. 143 describing the "444" and other anti-friction carriers

STEPHENS-ADAMSON MFG. CO.
Aurora, Illinois
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Branches in all principal cities

STEPHENS-ADAMSON
S-A BELT CONVEYORS

Volume 123 New York, April 23, 1927 *Number* 17

ENGINEERING AND MINING JOURNAL

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Contents

Editorials 673

- Copper Companies Make Remarkable Record
- Migratory Mining Engineers
- New Uses for Silica
- Babson, the Boy, and Mining
- Splitting Up High-Priced Stocks
- Using the Mails to Defraud
- Dust Respirators

***Birmingham as an Industrial Center** 676
By Albert H. Fay

On Ore Magmas—II 682
By J. H. L. Vogt

The Myth of Eldorado 685
By T. A. Rickard

Osmiridium Mining in Tasmania 688
By Percy O. Lennon

Discussion 690

- Pearls in Oysters
- Support for the Divining Rod

Useful Operating Ideas 691

- Use of Explosives in Drift Rounds

Professional Directory 39-41

Searchlight Section 43-45

Mining News 693

- Ample Authority Exists for Federal Aid
- New Interest in North Carolina Gold Mining
- Court Verdict to Tubercular Employee
- Marquette Range Ore Loading Begins
- Many New Operations in Colorado

Societies, Addresses and Reports 700

- American Zinc Institute Meets in St. Louis

Men You Should Know About 702

Obituaries 702

Lack of Invention Shown in French Patent on Electrolytic Zinc 703

New Publications 704

New Machinery 705

- The Lewis Traveling Cantilever Girder
  By C. M. Buck

Market and Financial News 707

Market Report 710

Mining Stocks 712

What and Where to Buy 46-48

Advertising Index 50

*Illustrated Article

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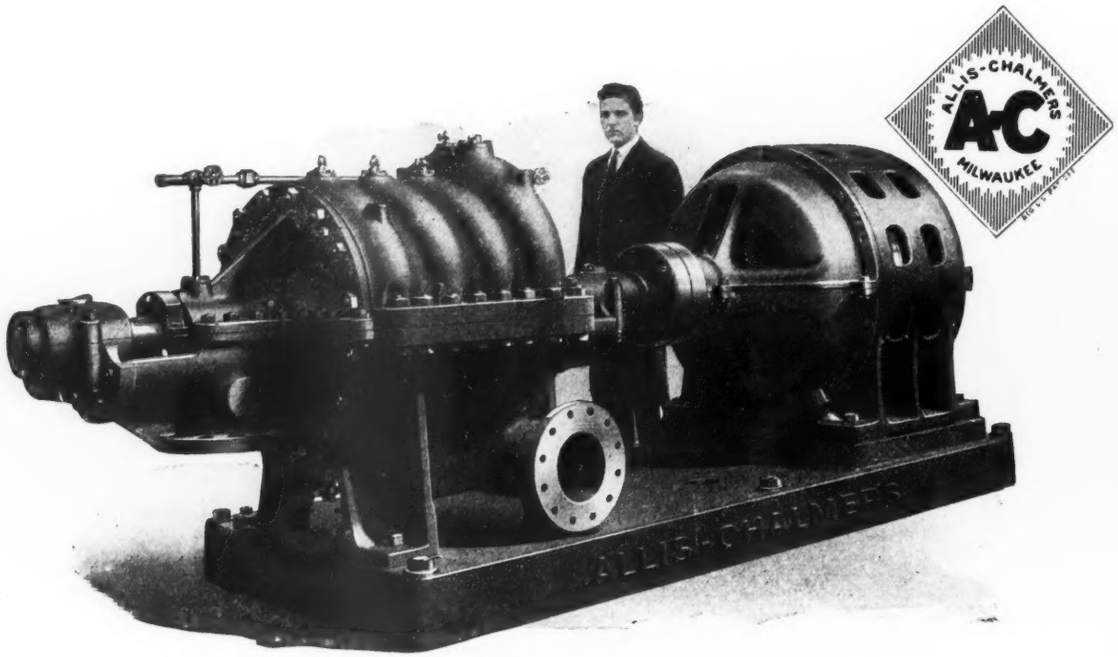

REPEAT ORDERS

This advertisement is written by a satisfied user of Allis-Chalmers multi-stage centrifugal pumps

"In April, 1919, we ordered from you three (3) 4-in., 5-stage centrifugal pumps, each direct connected to 150 H.P. induction motor of your make.

This equipment proved such an improvement over our old installation that we ordered, in June the same year, five (5) more of these units.

In July, 1920, we ordered four (4) more pump units with two-hundred horsepower motors, and an additional unit in December of the same year. I take pleasure in advising you that these units have given excellent service. You can see from the repetition of orders that we are well satisfied with the equipment."

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

ENGINEERING AND
MINING JOURNAL

Volume 123 New York, April 23, 1927 *Number* 17

Copper Companies Make Remarkable Record

THE ANNUAL REPORTS of the large copper companies, covering operations in 1926, offer the very best evidence with which to discomfit those who continue to bewail what they assume to be the deplorable condition of the copper industry. Several points stand out: a generally higher production than in 1925; a greater net profit, with the percentage of increase in profit greater than the percentage increase in production; more liberal dividends; and lower costs per pound of copper produced, even with a lower grade of ore mined. And in 1926, it must be remembered, the price of copper averaged below the level of 1925; in fact, it was well under 14c. per pound at the refineries.

Of the companies whose reports have been received at the time of writing, Utah, with a production of 234,000,000 lb., and Nevada Consolidated, with a production of 231,000,000 lb., are of outstanding importance. Utah's production increased by 9 per cent over that of 1925, but its profits increased 14 per cent, costs being cut from 8.43c. per pound to 7.94c. Nevada Consolidated's production increased by 7 per cent, but its net profits jumped 24 per cent, costs being reduced from 11.10c. to 10.53c. per pound of copper. Similar relations are shown by Calumet & Arizona and New Cornelia, only in the records of those companies net income was more than twice as great in 1926 as in 1925, though only a modest increase in production was made. Magma is another company in the same class, with a 26 per cent increase in net profit and an 8 per cent increase in production. Miami's net income increased only slightly, but its cost of production dropped from 11.23c. to 10.62c. per lb. Nor should the Michigan companies be overlooked: both Calumet & Hecla and Mohawk made notable increases in profits, with less notable increases in production.

How was this prosperity attained? Not by mining richer ore. Not by a smaller production at high prices. It has been brought about by the technical men of the industry who have devised improved mining and metallurgical processes, materials, and equipment, securing higher recoveries by cheaper methods. Their recommendations have been brought to fruition by the officials and directors who have appropriated the money to scrap obsolete equipment. Some plants have been almost entirely made over in the last two or three years; some companies have opened up mines of what was previously waste rock, treating the material by an entirely different method than that theretofore followed. Nor are all the technical men working at the mines; thousands of dollars are being saved the mining companies by researches carried on in well-equipped laboratories and shops in Wilmington, New York, Schenectady, Pittsburgh, Cleveland, Chicago, Milwaukee, Denver, Salt Lake City, San Francisco, and other smaller places.

The record of the copper companies last year is one for which no excuses need be offered, and is a remarkable example of the ability of producers to surmount difficulties, the chief of which was a comparatively low price for their product. The current year is still young. At the moment the price of copper is disappointingly below last year's average, but with an enormous buying movement impending in the United States and improved market conditions abroad, higher levels may reasonably be expected.

There seems no reason to feel that in 1927, as in 1926, the large copper producers will not again share liberally in the country's prosperity.

Migratory Mining Engineers

AT A RECENT MEETING of mining engineers in New York there were present five Americans, one of whom had come from each of the following countries: Mexico, Yukon Territory, Chile, Burma, and Rhodesia. There is nothing particularly unusual in this, for mining engineers are prone to roam the world; indeed, a dozen other men fresh from foreign countries were also present. It was a coincidence, however, that the five had known each other and worked in the same Nevada mining camp twelve years before. In the interval each had been employed in three or more other districts. The occasion for the visit to New York for two was to find new jobs; two others were on leave of absence from work in foreign countries; and the fifth was on his way from one assignment to another for the same company.

It is safe to say that in no other profession or occupation do men move from place to place, from country to country, and from continent to continent, so frequently and so easily as does the mining engineer. The reasons for this are not hard to find. For one thing, by temperament the average mining engineer is something of an adventurer. Otherwise he would not have chosen to study mining, or at least he would not have stayed with it after a brief experience in the field. He is not disposed to remain too long on one job.

Moreover, the character of the industry compels frequent change. The average life of mines is short. Many new properties are developed for a few years and then are abandoned. Many good mines are worked out in six or eight years. In the span of fifteen years the camp of Goldfield, Nev., sprang out of a hilly desert, rose to some eminence in the mining world, and subsided to virtually nothing. When profits begin to decline a favorite remedy of mining company directors is to employ a new manager; and the new manager is likely to bring in new engineers to replace many men on the staff. Even in these days when big companies control mines in half a dozen regions, men are transferred from one to another as a means for promotion. Truly the mining engineer leads a migratory life.

Another characteristic of the industry is the com-

Mining Stocks—Week Ended April 9, 1927

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	46⅞	46¼	46⅜	Ap.16,May21	Q 0.75
Arcadian Consol.	Boston	*50	*40	*40		
Ariz. Com'l	Boston	7	7	7	Ja. 7, Ja. 28	0.50
Calaveras	N. Y. Curb	2 1/16	2	2 1/16		
Calumet & Arizona	New York	67	66⅛	66⅛	Ma. 5, Ma. 21	Q 1.50
Calumet & Hecla	Boston	15⅛	15⅛	15⅛	Fe.28, Ma.15	Q 0.50
Cerro de Pasco	New York	63	61⅛	62⅛	Ap.14, My.2	Q 1.00
Chile Copper	New York	36⅞	36⅛	36⅛	Ma.4,Apr.1,	Q 0.62½
Con. Coppermines	N. Y. Curb	3⅛	3	3⅛		
Copper Range	Boston	13⅜	13	13	Ap.2, My 2,	A 1.00
Crystal Copper	Boston Curb	*27	*26	*26		
East Butte	Boston	2⅛	2	2	Dec., 1919	0.50
Granby Consol.	New York	36⅛	35⅛	35⅜	May, 1919	1.25
Greene-Cananea	New York	38⅛	33	36⅛	Nov., 1920	0.50
Hancock	Boston			*60		
Howe Sound	New York	38⅛	38	38⅛	Apr.1,Apr.15	Q 1.00
Inspiration Consl.	New York	19⅛	19	19	Ma.17, Ap.4,	Q 0.25
Iron Cap	Boston Curb	2	2	2		
Isle Royale	Boston	10⅛	10⅛	10⅛	Fe.4, Fe.19	Q 0.50
Kennecott	New York	62⅛	61⅛	62⅛	Mar. 4 Apr. 1	Q 1.25
Magma Copper	New York	34⅛	33⅛	34⅛	Ma.31,Ap.15,	Q 0.75
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Miami Copper	New York	15⅛	15⅛	15⅛	My.2,My.16	Q 0.37½
Mohawk	Boston	39⅛	39	39⅛	Ja.29, Ma.1	Q 1.00
Mother Lode Con.	New York	4½	4⅛	4⅛	De.10, De.31	SA 0.37½
Nevada Consol.	New York	14⅛	14	14⅛	Ma.17,Ma.31	Q 0.37½
New Cornelia	Boston	22⅛	22⅛	22⅛	Fe.4, Fe.21	Q 0.50
Noranda	N. Y. Curb	21⅛	20⅞	21⅛		
North Butte	Boston	2⅛	1⅝	1⅞	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*45	*42	*45	Sept., 1926	0.03
Old Dominion	Boston	15	14⅛	14⅛	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb			126⅛	Ma.22, Apr.2	Q 1.50
Quincy	Boston	16⅛	16	16	Mar., 1926	1.00
Ray Consolidated	New York	15	14⅞	15	Ap.20, Ap.30	0.25
St. Mary's Min. Ld.	Boston	21⅛	21⅛	21⅛	Fe.10 Ma'10	2.00
Seneca Copper	New York	2⅛	1⅞	2⅛		
Shattuck-Denn	Boston Curb	4⅞	4⅜	4⅜		
Tenn. C. & C.	New York	11⅛	11	11⅛	Fe.28, Ma.15,	Q 0.25
United Verde Ex.	N. Y. Curb	26	25⅛	25⅛	Apr.6, May1	Q 0.75
Utah Copper	New York			112	Ma.17,Ma.31	Q 1.50
Utah Metal & T.	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	*54	*50	*54		
NICKEL-COPPER						
Internat. Nickel	New York	47⅛	41⅛	46⅞	Ma.17,Ma.31	Q 0.50
Internat. Nickel, pfd.	New York			105	Ap.14,My.2	Q 1.50
LEAD						
Gladstone Mtn.	Spokane	*28	*24	*25½	March, 1927	0 005
National Lead	New York	195	191	191	Ma.11,Ma.31	Q 2.00
National Lead pfd.	New York	126½	125	126	March, 1927	Q 1.75
St. Joseph Lead	New York	41⅛	40⅛	40⅛	Jn.10,Jn.20,	QX 0.75
ZINC						
Am. Z. L. & S.	New York	9⅛	8⅛	9	May, 1917	1.00
Am. Z. L. & S, pfd.	New York	50⅛	48⅛	48⅛	Nov., 1920	1.50
Butte C. & Z.	New York	4	3⅛	3⅛	De.9, De.24	0.50
Butte & Superior	New York	9⅛	7⅛	9	Ma.15, Ma.31	Q 0.50
Callahan Zn-Ld	New York	1⅛	1⅛	1⅛	Dec., 1920	0.50
Consol. Lead&Zinc'A'	St. Louis	14⅛	13⅛	13⅛	Ma.15, Ap.1	Q 0.25
Eagle-Picher	Cincinnati	28⅛	27⅛	28	Fe.15, Ma.1	Q 0.40
Eagle-Picher, pfd.	Cincinnati			100	De.31, Ja.15	Q 1.50
New Jersey Zn.	N. Y. Curb	193⅛	186	190	Ja.20, Fe.10	Q 2.00
United Zinc	N. Y. Curb			55		
Yellow Pine	Los Angeles	*25	*25	*25	Dec. 1925	Q 0.04
GOLD						
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Argonaut	Toronto	*43	*37½	*43		
Barry-Hollinger	Toronto	*44½	*36	*42½		
Carson Hill	Boston			*50		
Consol. W. Dome L.	Toronto	*7⅛	*7⅛	*7⅛		
Cresson Consol. G.	N. Y. Curb	2⅛	2⅛	2⅛	Ma.31,Ap.10	Q 0.10
Dome Mines	New York	9	8⅛	8⅛	Ap.18, My5	Q 0 25
Golden Cycle	Colo. Springs	†1.71	†1.69		Fe.28,Ma 10	Q 0 04
Hollinger Consol.	Toronto	20.95	20 75	20.80	Ap 6, Ap.20	0 10
Homestake Mining	New York	62⅛	62	62	Ap.20,Ap.25	M 0.50
Kirkland Lake	Toronto	1.09	*87	1.07		
Lake Shore	Toronto	18 75	18 00	18 55	Ma.1, Ma.15	0.10
McIntyre-Porcupine	New York	24⅛	24⅛	24⅛	Fe.1, Ma.1	Q 0 25
Portland	Colo Springs	†*50	†*49⅛		Ap.6, Ap.15,	Q 0.02
Rand Mines	New York			9⅛	Au.23-30Am.Sb.	1.52
Teck-Hughes	Toronto	6.95	6.52	6 82	Ja.31, Fe. 1	0.05
Tom Reed	Los Angeles	*52	*50	*52	Dec., 1926	0.02
Tough-Oakes	Toronto	*54½	*43	*53		
United Eastern	N. Y. Curb	*44	*43	*44	July, 1924	0.05
Vipond Cons.	Toronto	1.46	1.40	1.46	Apr.1 Apr.15	0.03
Wright-Hargreaves	Toronto	10.65	10.52	10.60	Ap.15,My.2	0.10
GOLD AND SILVER						
Carnegie Metals	Pittsburgh	*13	*12½	*13		
Con. Cortez	N. Y. Curb	*24	*20	*24		
Con. Virginia	San Francisco	*4⅛	*4⅛	*4⅛		
Dolores Esperanza	N. Y. Curb			*35	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅛	2 1/16	2 1/16	Ma.15, Ap.4	Q 0.08
Tonopah Belmont	N. Y. Curb	2	1⅞	2	Ma.15, Ap.4	0.08
Tonopah Extension	N. Y. Curb			*32	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	2⅛	2	2	Ma.31, Apr.21	0.07½
West End Consol.	N. Y. Curb	*12	*10	*12	Mar., 1923	0.05
Yukon Gold	N. Y. Curb			*45	June, 1918	0.02
SILVER						
Beaver Consol.	Toronto	*80½	*63	*76½	May. 1926	0.03
Canadian Lorrain	Toronto	*39⅛	*35	*36½		
Castle-Trethewey	Toronto	1.06	*96	1.00		
Coniagas	Toronto	3.85	3.41	3 75	May. 1924	0.12½
Keeley	Toronto	1.46	1.40	1.43	Fe 28, Ma.15	X 0.12
Lorrain Trout Lake	Toronto			*35	July, 1925	0.05
McKinley-Dar.-Sav.	Toronto	*13½	*13	*13½	Oct., 1920	0.03

Stock	Exch.	High	Low	Last		Last Div.
SILVER—(Continued)						
Mining Corp. Can.	Toronto	3.65	3.20	3.53	De.30, Ja.15	0.12½
Nipissing	N. Y. Curb	7⅛	7⅛	7⅛	Ma.31, Ap.20	Q 0.15
SILVER-LEAD						
Ahumada	New York	4⅛	4⅛	4⅛	Ma 25,Ap.4,	QX 0.12½
Bingham Mines	Boston	41⅛	41⅛	41⅛	Ma.21, Ap.5	Q 1.00
Bunker Hill&Sullivan	N. Y. Curb	74⅛	74	74⅛	Ma.31,Ap.4	MX 0.50
Cardiff M. & M.	Salt Lake			*38	Feb. 5, 1927	0.10
Chief Consol.	Salt Lake	2.65	2.50	2.60	Oc.10, No.1	Q 0.10
Consti'n Mng.&Mill'g	Spokane	*33	*30	*33		
Erupcion	Boston Curb	*75	*65	*65	Ma.25, Ap.2	Q 0 07½
Eureka Lily	Salt Lake	1.37½	1.22½	1.37½		
Federal M. & S.	New York	112	112	112		
Federal M. & S., pfd.	New York	95⅛	92⅛	95⅛	Fe.24, Ma.15	Q 1.75
Hawthorne Mines	N. Y. Curb	*5	*4	*5		
Hecla Mining	N. Y. Curb	14⅛	14⅛	14⅛	Fe.15,Ma.15	Q 0.25
Highland-Surprise	Spokane	*10⅛	*9	*9		
Iron King Mining	Salt Lake	*43	*37	*40		
Keystone Mining	Salt Lake	*32	*32	*32	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*20⅛	*19	*19⅛		
Lucky Tiger-Com.	Kansas City	†7.15	†6.62½		Ap.20, 1927	M 0.05
Mammoth Mining	Salt Lake			2.00	De.17, De.23	Q 0.25
Marsh Mines	Spokane	2⅛	2⅛	2⅛		
North Lily	Salt Lake	2.90	2.50	2.90		
Park Utah	New York	7	6⅞	7	Ma.15, Ap.1	Q 0.20
Plutus Mining	Salt Lake			2.00	Ja.10, Ja.15	Q 0.10
San Rafael	San Francisco			*24		
Silver King Coal	Salt Lake	7.60	7.55	7.55	Ma.21, Ap.1	Q 0.25
Silversmith	Spokane	*33⅛	*28	*33⅛	Oc.1, Oc.10	Q 0.02
Strattons Mines	Spokane	*45	*43⅛	*45		
Sunshine M. Co.	Spokane	*56⅛	*52	*55		
Tamarack-Custer	Spokane	*32	*30	*31⅛	Sept., 1924	0.25
Tintic Standard	Salt Lake	10.75	10.62½	10.75	Ma.16, Ma.29	X 0 40
Utah-Apex	Boston	6⅛	5⅛	5⅛	Oct., 1926	0.25
IRON						
Bathlehem Steel	New York	56½	52⅝	55½	July, 1924	1.25
Butler Bros.	Chicago	23½	22	22⅛	Ja. 29, Fe. 15	Q 0.625
Cleveland-Cliffs Iron	Cleveland	80	77	77	Ja.15, Ja.25	Q 1.00
Colorado Fuel & Iron	New York	76⅛	66⅛	72⅛	May, 1921	0.75
Gt. North'n Iron Ore	New York	21⅛	20⅛	20⅛	Dec.6, Dec.28	0.75
Inland Steel	New York	43	42½	43	Fe.15, Ma.1	Q 0.62½
Replogle Steel	New York	10⅞	10	10⅛		
Republic I. & S.	New York	72⅛	69⅛	71⅛	Fe.15,Ma. 1	Q 1.0
Republic I. & S. pfd.	New York	104½	104	104	Ma.15, Ap.1	Q 1.75
Sloss-Sheffield S. & I.	New York	134½	130	131½	Ma.10, Ma.21	Q 1.50
Sloss-Shef. S.&I. pfd.	New York	107	107	107	Ma 21, Ap.1	Q 1.75
U. S. Steel	New York	172⅛	169	171	Fe.28,Ma.30	Q 1.75
U. S. Steel pfd	New York	133	132	132	Ja.29, Fe.26,	Q 1.75
Virginia I. C. & C.	New York			44	Jan., 1924	1.50
Virginia I.C.&C.pfd.	New York			60⅛	De.15. Ja.2,	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York			30⅛	Ja.26, Ja.29	1.45
So. Am. Gold & P.	N. Y. Curb	3⅛	3⅛	3⅛		
Alum.Co.of Amer.	N.Y.Curb	68	68	68		
Alum. Co. of Amerpf.	N.Y.Curb	104	104	104	Ma.15,Ap.1	Q 1.50
Vanadium Corp.	New York	52	50	50⅞	Fe.1, Fe.15,	Q 0.75
Patino M. & E.	New York	23⅛	21⅛	23⅛	Ma.10, Ma.15	4 sh.
ASBESTOS						
Asbestos Corp.	Montreal	24	22⅛	22⅛	Jan., 1926	1.50
Asbestos Corp., pfd.	Montreal	87⅛	87	87⅛	Ma.31,Ap.15	Q 1.75
SULPHUR						
Freeport Texas	New York	74⅛	58⅛	74⅛	Ap.15, Ma.2	Q 1.00
Texas Gulf, new	New York	65½	59⅛	64⅛	Ma.1, Ma.15	Q 1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	42⅜	42	42	Fe.18, Ma. 1	Q 0.75
Amer. Metal pfd.	New York			110⅛	Fe.19, Ma.1	Q 1.75
Amer. Sm. & Ref.	New York	148⅛	143	148⅛	Ap.14, My.2	Q 2.00
Amer. Sm.&Ref.pfd.	New York	122	121⅛	121⅛	My.6, Jn.1	Q 1.75
Consol. M. & S.	Montreal	264	258⅛	260	De.31, Ja.15	X 6.25
Federated Metals	N. Y. Curb			13		
Newmont Mining	N. Y. Curb			77⅛	Ma.31,Ap 15	Q 0 60
U. S. Sm. R. & M.	New York	38⅛	36⅛	36⅛	Ap.7 Ap.15	Q 0 87½
U. S. Sm. R.&M.pfd.	New York	49	47½	47½	Ap.7, Ap. 15,	Q 0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED MARCH 29, 1927

Name	High	Low	Last	Date	Amount	Last Div.
Aramayo Mines (25 frs.)	85/7½	84/4½	85/-	Feb. 1927	5 (†)	
British Platinum (£1)	4/6	3/—	4/—	Feb. 1925	2½ p.c.	
Burma Corpn. (10 rupees)	14/3	13/9	14/—	Feb. 1927	6 annas*	
Bwana M'Kubwa (5s)	6/6	6/3	6/4½			
Camp Bird (2s)	5/—	4/6	5/—			
El Oro (£1)	4/6½	4/1½	4/4½	Nov. 1924	2½ p.c.*	
Esperanza (10s)	—/2	—/2	— 2			
Frontino & Bolivia (£1)	13/1½	11/10½	12/6	Jan. 1927	5 p.c.	
Mexican Corpn. (£1)	9/6	9/—	9/6			
Mexico Mines of El Oro (£1)	16/3	15/1½	16/3	Dec. 1926	3½ p.c.*	
N'Changa Copper Mining	13/6	12/—	12/—			
Oroville Dredging (£1)	7/—	6 7½	6/9	Dec. 1923	3½ p.c.	
Ouro Preto (£1)	2/1½	2/—	2/—	May 1925	2½ p.c.	
Rhodesian Congo Border (£1)	63/9	61/3	62/6			
St. John del Rey (£1)	13/—	12 4½	12/6	May 1927	3½ p.c.	
San Francisco Mines (10s)	30/6	30/—	30/3	Jan. 1927	2s.	
Santa Gertrudis (£1)	15/6	15/—	15/3	Jan. 1927	3½ p.c.	
Selukwe (2s. 6d.)	10/7½	9/1½	10 6	April 1917	6½ p.c.	
S. Amer. Copper (2s.)	3/6	3/—	3/3	Nov. 1917	75 p.c.	
Tanganyika (£1)	63/9	47/9	51/10½	Aug. 1926	7½ p.c.	
Tomboy (£1)	3/6	3/3	3/3	July 1926	10 p.c.	
Union Miniere du Haut-Katanga (Brussels)	9.300	8.750	9.300	July 1926	175 (‡)	

* Free of British income tax. † Swiss frs. ‡ Belgian frs. and free of taxation.

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ENGINEERING AND
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Copper Companies Make Remarkable Record

THE ANNUAL REPORTS of the large copper companies, covering operations in 1926, offer the very best evidence with which to discomfit those who continue to bewail what they assume to be the deplorable condition of the copper industry. Several points stand out: a generally higher production than in 1925; a greater net profit, with the percentage of increase in profit greater than the percentage increase in production; more liberal dividends; and lower costs per pound of copper produced, even with a lower grade of ore mined. And in 1926, it must be remembered, the price of copper averaged below the level of 1925; in fact, it was well under 14c. per pound at the refineries.

Of the companies whose reports have been received at the time of writing, Utah, with a production of 234,000,000 lb., and Nevada Consolidated, with a production of 231,000,000 lb., are of outstanding importance. Utah's production increased by 9 per cent over that of 1925, but its profits increased 14 per cent, costs being cut from 8.43c. per pound to 7.94c. Nevada Consolidated's production increased by 7 per cent, but its net profits jumped 24 per cent, costs being reduced from 11.10c. to 10.53c. per pound of copper. Similar relations are shown by Calumet & Arizona and New Cornelia, only in the records of those companies net income was more than twice as great in 1926 as in 1925, though only a modest increase in production was made. Magma is another company in the same class, with a 26 per cent increase in net profit and an 8 per cent increase in production. Miami's net income increased only slightly, but its cost of production dropped from 11.23c. to 10.62c. per lb. Nor should the Michigan companies be overlooked: both Calumet & Hecla and Mohawk made notable increases in profits, with less notable increases in production.

How was this prosperity attained? Not by mining richer ore. Not by a smaller production at high prices. It has been brought about by the technical men of the industry who have devised improved mining and metallurgical processes, materials, and equipment, securing higher recoveries by cheaper methods. Their recommendations have been brought to fruition by the officials and directors who have appropriated the money to scrap obsolete equipment. Some plants have been almost entirely made over in the last two or three years; some companies have opened up mines of what was previously waste rock, treating the material by an entirely different method than that theretofore followed. Nor are all the technical men working at the mines; thousands of dollars are being saved the mining companies by researches carried on in well-equipped laboratories and shops in Wilmington, New York, Schenectady, Pittsburgh, Cleveland, Chicago, Milwaukee, Denver, Salt Lake City, San Francisco, and other smaller places.

The record of the copper companies last year is one for which no excuses need be offered, and is a remarkable example of the ability of producers to surmount difficulties, the chief of which was a comparatively low price for their product. The current year is still young. At the moment the price of copper is disappointingly below last year's average, but with an enormous buying movement impending in the United States and improved market conditions abroad, higher levels may reasonably be expected.

There seems no reason to feel that in 1927, as in 1926, the large copper producers will not again share liberally in the country's prosperity.

Migratory Mining Engineers

AT A RECENT MEETING of mining engineers in New York there were present five Americans, one of whom had come from each of the following countries: Mexico, Yukon Territory, Chile, Burma, and Rhodesia. There is nothing particularly unusual in this, for mining engineers are prone to roam the world; indeed, a dozen other men fresh from foreign countries were also present. It was a coincidence, however, that the five had known each other and worked in the same Nevada mining camp twelve years before. In the interval each had been employed in three or more other districts. The occasion for the visit to New York for two was to find new jobs; two others were on leave of absence from work in foreign countries; and the fifth was on his way from one assignment to another for the same company.

It is safe to say that in no other profession or occupation do men move from place to place, from country to country, and from continent to continent, so frequently and so easily as does the mining engineer. The reasons for this are not hard to find. For one thing, by temperament the average mining engineer is something of an adventurer. Otherwise he would not have chosen to study mining, or at least he would not have stayed with it after a brief experience in the field. He is not disposed to remain too long on one job.

Moreover, the character of the industry compels frequent change. The average life of mines is short. Many new properties are developed for a few years and then are abandoned. Many good mines are worked out in six or eight years. In the span of fifteen years the camp of Goldfield, Nev., sprang out of a hilly desert, rose to some eminence in the mining world, and subsided to virtually nothing. When profits begin to decline a favorite remedy of mining company directors is to employ a new manager; and the new manager is likely to bring in new engineers to replace many men on the staff. Even in these days when big companies control mines in half a dozen regions, men are transferred from one to another as a means for promotion. Truly the mining engineer leads a migratory life.

Another characteristic of the industry is the com-

paratively large number of technical men in proportion to craftsmen and laborers that are employed in the conduct of mining and metallurgical operations. The ratio is much higher, for instance, than in the construction of a railway or a big hydro-electric installation. As a consequence a large body of mining engineers is constantly circulating all over the world; for ore deposits are found from the Arctic to the Antarctic, and they have no preference as to longitude. By and large, these engineers speak the English language. Most of them are Americans; most of the rest are British.

And as illustrated in the instance of the five who met in New York, the extent to which the men in the fraternity are acquainted with each other, or at least with mutual friends, is astonishing to one who is not familiar with the conditions peculiar to the industry. "So you worked in Butte; when was that?" asks one engineer after the first five minutes' conversation with a new acquaintance. "In 1914." "Well, that was after my time; but you probably knew Curley Jones." "Did I? He and I shifted together at the Never Sweat." "Is that so? Well, Curley signed up for three years at Andes about six months ago." The probability is that a dozen other mutual friends will be discovered, with homes scattered anywhere from Juneau, in Alaska, to Johannesburg, in South Africa.

This situation explains why many subscribers to the *E. & M. J.*—so they tell us—open their paper first at the personal page and then to the news section. They want to see whether any of the hundreds of "Curley Joneses" that they know has gotten a job somewhere as general manager. It is just possible, if he has, that he will need a good superintendent for his flotation plant. At any rate they like to keep track of their friends.

The *Engineering and Mining Journal* confesses that it would like to play the part of silent carrier of news of this kind better than it does. To do so it needs the co-operation of those who get the promotions or do the moving. If you want to let your friends know what you are doing in the easiest and most effective way, write a letter to the *Engineering and Mining Journal*. It will take pleasure in publishing the facts; and you may be sure that your friends all over the world will be glad to know of your peregrinations, just as you are interested in theirs.

New Uses for Silica

SILICA occurs as a number of different minerals such as quartz, opal, tridymite, and other closely related species. Its present utilization extends into many industries, ranging from glass-making in all of its ramifications from high-grade optical glass to ordinary bottle glass, to the gem cutter who prepares precious opal for his trade. The chemist makes use of fused silica in the construction of delicate apparatus. One of the comparatively recent developments is the growth of the diatomite industry. Many deposits of diatomite occur, but apart from an incidental demand for polishing and tooth powders, diatomite did not come into its own until commercial enterprise energetically directed attention to the discovery of new uses for this valuable mineral. Such uses were developed, and now an important business has been established in heat-insulating materials, filtering media, paint fillers, and more recently in the application of diatomite as an admixture with concrete to increase its soundness and uniformity. Intensive sales effort has played a part in bringing this about; for human inertia remains, as it will be always, more or less an obstacle to the introduction of new things.

A greater expansion in the uses of silica, chiefly through applications of sodium silicate, is now under way by a California company. Generally, silicate of soda (water glass) is thought of in relation to preserving eggs, which it does efficiently; but there are other uses, such as in soap making, in trunk veneers, in pottery, in silk-weighting, in paper sizing, in corrugated board boxes, in grinding wheels, in fire retardants, and in cements. It is finding some application as a concrete hardener, and for dust-proofing and water-proofing. Other uses are in peroxide bleaching of textiles and for rust prevention.

Research is a fundamental in the success of the non-metallic mineral industry. No less so is systematic sales effort, as has been demonstrated in the instance of diatomite and in this last campaign to expand the demand for silicate of soda.

Babson, the Boy, and Mining

ROGER W. BABSON expresses his views on the mining industry in the fifth of a series of ten articles entitled "Your Boy's Business" now appearing in many newspapers of the country. His published intention is to direct the boy seeking his life work, to help the business man engaged in industry, and to outline investment possibilities to the investor. The mining profession will take exception to many of Mr. Babson's opinions. To quote his direction to the boy seeking his life work, which, according to the title given the series, presumably should be significant: "The real truth is that the hardships of the profession make it rather unpopular at present. The very experiences which attracted young men thirty years ago now are looked upon as handicaps. Bathrooms, parlor cars, and theaters, which then were looked upon as luxuries, are now considered necessities. . . . The profession is now classed with the merchant marine as suitable only for those who do not care for a home."

As a student of the mining industry, Mr. Babson shows himself to be an excellent economist. A visit to a few of the many mining schools of the country, with a side trip, here and there, to several of the modern mining camps, is suggested. Also, it might be added, real youth, as ever, will be attracted by hardships. As to a similarity existing between home life in the profession of mining and that in the merchant marine—perhaps "Tell it to the Marines" will suffice.

Splitting Up High-Priced Stocks

WHEN A SHARE OF STOCK sells above $200 a decision is usually made by the directors to split the capitalization into a larger number of units. Of the stocks that are at all active on the New York Stock Exchange, for example, only four are selling above $200—Jersey Central Railroad, Commercial Solvents, Du Pont de Nemours, and U. S. Cast Iron Pipe & Foundry. The chief reason for the split-up is usually to give a wider market to the stock, for most investors would prefer to buy ten shares of a $25 stock rather than one of a $250 security. As a result of the added

interest in the low-priced stock, the fluctuations are greater; the $25 stock will advance to $30 much more readily that the $250 stock will go to $300. But the split-up is usually justified on more solid grounds than this, for when a stock advances far over par, earnings have usually been plowed back into the enterprise so that the amount of outstanding stock is far below the amount of capital actually invested.

A conspicuous example of a mining stock that has gone above $200, and the only one that has done so among those quoted in the list at the end of each issue of *E. & M. J.*, is Consolidated Mining & Smelting of Canada, the phenomenal British Columbia company that is controlled by the even more phenomenal Canadian Pacific Railway, otherwise known as the C. P. R. At the last annual meeting some of the minority stockholders suggested, according to the report before us, that "to allow easier manipulation on the exchanges," the shares of the company should be divided. The directors, however, disapproved on the ground that the company was a producing, not a stock-jobbing, concern. "Manipulation" in this connection has an ominous sound; probably that was not exactly what the proponents of the idea had in mind, but if so, and if they were merely surprisingly frank in their choice of terms, the directors may be congratulated on having turned down the suggestion.

Using the Mails to Defraud

IN SENTENCING Murray J. Brady, former president of the Brady Sure Shot Oil Co., of Contra Costa County, Calif., convicted by a jury in the Federal court of San Francisco on an indictment that accused him of using the mails to defraud, Judge George M. Bourquin said, in part:

"This case is one that is too common in the aspect of fraud which it bears. The robberies that are committed upon the people by schemes such as yours amount to hundreds of millions of dollars every year. Unfortunately, the victims are mainly the poor and the elderly and those who, finding the struggle for existence growing harder as they grow old, are disposed to take ventures which, of course, they are not at all justified in taking.

"There is no law against your persuading them to join with you in any honest venture, but when you do it by misrepresentations, by false statements, by promises made with no intention of performing them, it becomes a fraud; and when you use the mails you make the Government of the United States a quasi partner in your nefarious business and you run counter to this particular statute and incur the penalty of the law.

"These people whom you have defrauded are a good many," said the court, "and their losses run up to something like $100,000. They are elderly people, who worked hard, if we can judge anything by their appearance. It would seem, judging from some of the testimony introduced in this case, that you took about all they had. You have unquestionably darkened their later years and have shortened the lives of some of them."

Judge Bourquin touches upon one element of a national evil. His comment upon the United States as a quasi partner with the culprit through the use of the mails brings out the definite responsibility of the third party. Misuse of the government mails is a factor. Misuse of the advertising pages of publications such as newspapers is another factor in making possible the sale of questionable securities. Many newspapers take their obligations lightly, but they are just as much a party to fraud when they permit the publication of misleading statements in advertisements as the man who submits the copy to them.

The Federal Government endeavors to maintain the wholesomeness of the matter transported in its mails. Some newspapers have excellent standards. Many others, unwittingly or otherwise, become partners in robbing the public through the sale of fake securities. There is manifestly a need for such newspapers to reestablish their good name by refusing to be made a party to misrepresentation.

Dust Respirators

THE MINING INDUSTRIES can never get away from dust, in one form or other. Measures can be taken to lessen its production and to reduce the density of suspensions, but as rock or mineral must be broken that it may be removed, the production of some fines is inevitable. Dust suspensions are objectionable principally for hygienic reasons; but, as is well known, in coal mining they are also a menace to safety by reason of the explosive mixture which the coal dust forms with air.

One of the obvious methods of overcoming the difficulty of dust suspensions is by the use of respirators or filters. The efficacy of respirators has always been open to question, in spite of the many different devices that have been invented and used. Experience in the war developed the gas mask and along with it renewed interest in respirators in general. A thorough study of different kinds of dust filters and respirators was recently completed by the Bureau of Mines, and the results have been published in Technical Paper No. 394. The authors, Messrs. Katz, Smith, and Meiter, state that "although the use of respirators should be encouraged among workers in dusty industries, a respirator cannot be considered a final safeguard. In mining and in other industries efforts to prevent the formation of dust and its distribution by the air, by the use of hollow drill steel and water, and by sprays on the undercutting machines, should be continued."

The conclusion of these investigators agrees with general opinion. There is much valuable material, in the technical paper from which the quotation is made, upon the filtering capacity of different textiles. However, one line of investigation does not appear to have been given consideration, and that is the use of various textiles in conjunction with sticky or viscous fluids and with moisture. The most efficient of the respirators experimented with, as stated by the writers, was the Fogler flat-felt filter, which has, however, a high resistance, 2.25 in., although its efficiency is given as 97 per cent. It would thus appear that one of the important objectives to be achieved in the design of respirators is a lower air resistance. This involves the use of fabrics of looser texture than felt, but these fabrics are obviously not as efficient. The use of such fabrics in conjunction with various fluids seems to indicate another direction of approach toward a highly efficient respirator that will perhaps possess the advantage of lower air resistance than does the Fogler respirator.

Birmingham as an Industrial Center

The Iron and Steel Capital of the South

By Albert H. Fay
Mining Engineer, New York City

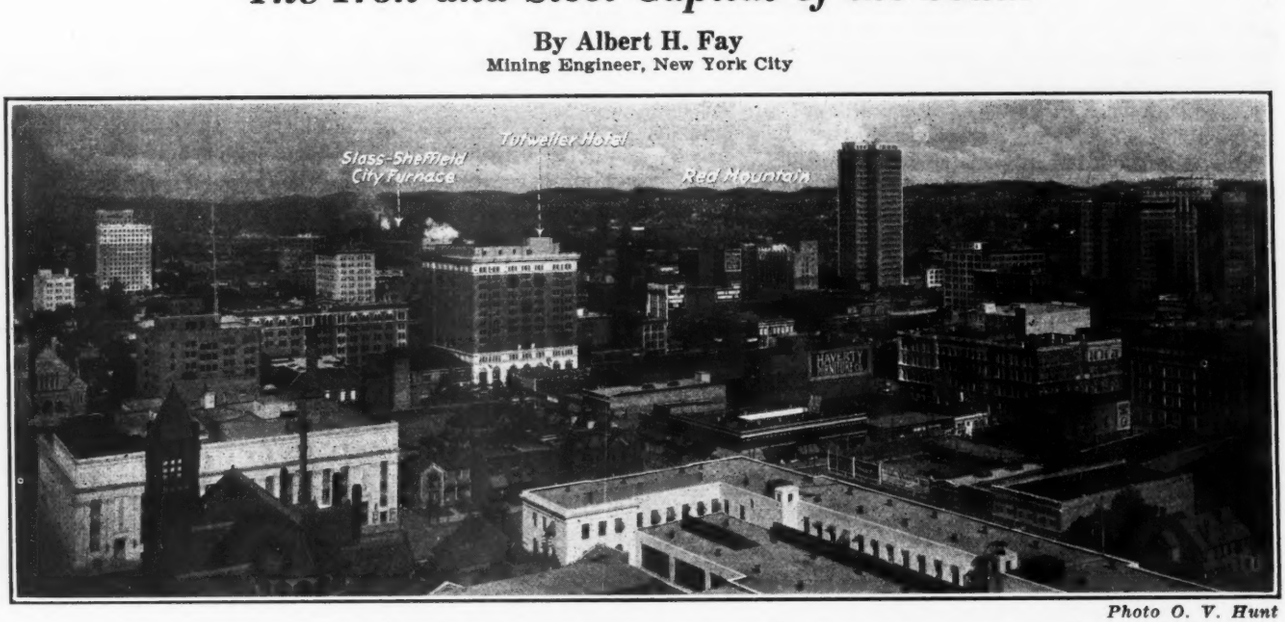


Photo O. V. Hunt

Panoramic view of Birmingham, with Red Mountain in background. Iron ore outcrop near top of mountain

IF SLOGANS alone made cities Birmingham would be larger than Chicago. In my short stay in Birmingham I saw at least seven slogans incorporated in signboards, in advertisements, and on automobiles, as follows: "The Industrial City," "The Magic City," "The Pittsburgh of the South," "The Steel City," "We Believe in Birmingham," "World's Largest Steel Center" and the "South's Steel Center."

Behind slogans must be something material, or they will be of no avail. The building of cities requires natural resources, of which Birmingham has an almost limitless supply, as of iron, coal, cement materials, water power, and agricultural lands. The farm lands now produce cotton and some corn, but are capable of further development by diversified and intensive farming and an introduction of more dairy stock, sheep, and hogs. Cotton alone will not make an agricultural community prosperous, so long as many of the farmers go to the village and buy vegetables and fruit.

Birmingham as a city knew not the strife and turmoil of Civil War days. The city was founded in 1871. In 1900 Birmingham had a population of 38,415 and in 1926 it was 247,548 within the corporate limits. The number of public school teachers in 1900 was 95 and in 1925 it was 1,187. During this period school facilities increased twice as fast as the population, which is a good sign. The weekly payroll in 1900 was $325,000 and in 1925 $4,200,000. The area of the city is 52 square miles. Its elevation is 600 to 1,500 ft. above sea level. The annual rainfall in 1925 was 49.48 inches. The mean temperature for the year 1925 was 63 deg. F.

Before the days of the Civil War, Abram S. Hewitt, a capitalist of New York, as early as 1857 secured options on the entire then known iron-ore field of the Birmingham district, expecting to begin operations; but as soon as the Civil War came on he had to abandon his project. The iron-ore deposits lay dormant for many years thereafter. During the first stages of mining, the ore was reduced to pig iron and shipped to other industrial centers for further fabrication. The first ton of steel produced in Alabama was made on Thanksgiving Day, 1899.

I was informed by two producers of pig iron that a few years ago more than 90 per cent of the iron production was shipped to points north of the Ohio River for further fabrication. This year about 7 per cent will be shipped north. The pig iron is now manufactured locally into stoves, cast-iron pipe, cotton gins, heavy mining machinery, structural steel and rails, and goes into the adjacent Southern markets. Of course, in former years it was not all re-shipped to Southern points for consumption, as markets were not good, the rank and file not being able to buy. With the increased circulation of money, which resulted through wages paid out in mines, mills, and factories, the people are able to buy things they could not afford before. Manufacture of raw products within the state has resulted in an increased number of industries, which in turn give employment to many more. It is a beneficial circle of industries, each making a market for the other, and all giving employment to an increased number who are able to buy, because the basic natural resources are being fabricated locally.

Coal and Iron Production in the Birmingham District

(Production in Tons)

Year	Pig Iron	Steel	Coal	Coke
1900	1,184,337	66,076	8,273,362	2,110,837
1910	1,939,147	529,684	16,139,228	3,231,399
1920	2,392,962	1,139,141	17,391,437	3,982,472
1921	1,207,408	709,175	13,015,017	2,547,664
1922	2,230,619	1,091,240	18,760,865	3,760,064
1923	2,797,190	1,274,293	20,919,303	3,750,187
1924	2,773,825	1,249,773	19,615,931	4,620,282
1925	2,815,688	1,400,000	20,408,656	4,608,639
1926	2,881,000	1,600,000	20,400,000	4,700,000

While the production of pig iron, coal, and coke has increased two and one-half times since 1900, many other industries have sprung up, so that bank deposits increased twelve times, post office receipts between fourteen and fifteen times, and bank clearances thirty times. The value of real estate has increased from $14,700,000

in 1900 to $173,600,000 in 1925, or 10.8 times. This remarkable growth has only been possible by manufacturing the products of the farms and mines in local industrial plants instead of shipping the raw material out of the state to be manufactured and then imported for domestic consumption and use. Formerly, as pig iron was shipped to the industrial centers of the Ohio Valley, so cotton was sent to the textile mills of New England. Now the major part of the pig iron is converted into steel and rolled and cut to commercial sizes

Growth of Business in City of Birmingham

(From Birmingham Chamber of Commerce)

Year	Real Estate Values	Bank Clearances	Bank Deposits	Post Office Receipts
1900	$14,727,707	$42,980,448	$7,006,000	$104,526
1910	65,815,026	130,248,528	22,923,000	379,857
1920	132,071,995	990,962,573	62,805,000	885,116
1921	140,453,580	899,335,311	56,328,109	860,388
1922	144,151,266	1,124,592,824	70,636,305	959,091
1923	145,737,466	1,305,871,357	80,071,268	1,117,856
1924	154,817,897	1,367,180,826	85,810,037	1,262,294
1925	173,591,742	1,372,382,901	93,742,010	1,435,471
1926	193,004,518	1,337,643,643	94,304,928	1,626,599

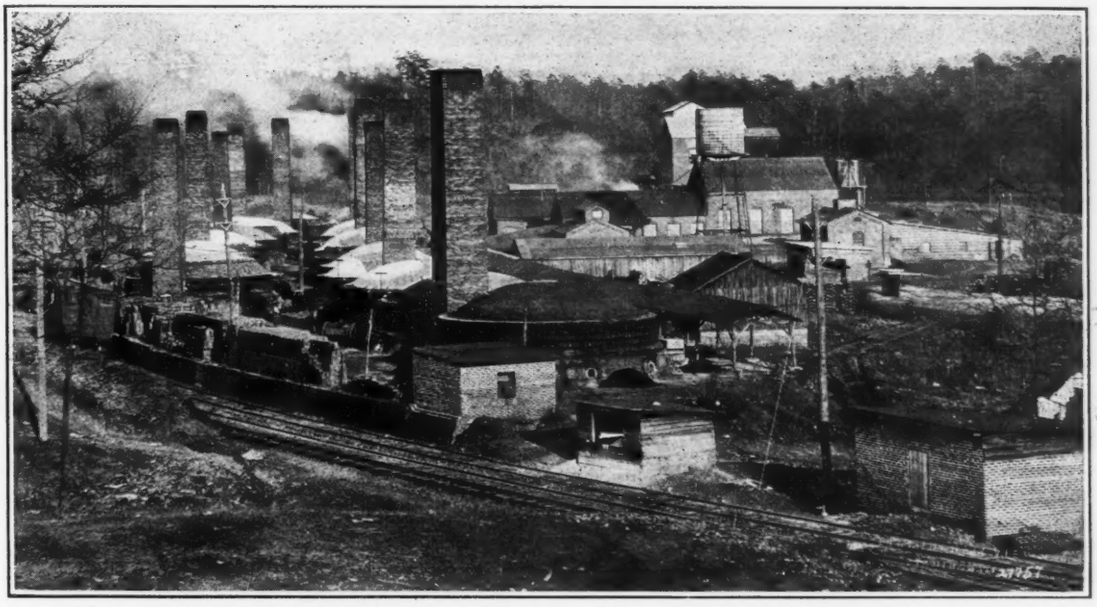
in local plants in Birmingham. As a result, Birmingham office buildings are constructed of iron that has not been transported to exceed 25 miles from mine to furnace, to mill and fabricating plant, and finally to its place of use. In some cases much less than this. One hoisting engine was pointed out to me as being manufactured in Birmingham from iron from the same mine in which the engine is now doing duty. This is as it should be. It is true, the practice will prevent a similar distant manufacturer from making sales in this district, but the savings so made, if local consumption and manufacture are continued to the fullest extent, should produce a community of sufficient wealth to be able to buy much more of other materials from Northern factories which cannot now be produced in the South, and for which there has been no market because many people could not afford to buy. Give a community plenty of work and good wages, and new markets will open.

The Birmingham district contains within a radius of 15 miles all of the material necessary for making pig iron and steel—red and brown iron ore, coal, and limestone. Much of the ore contains a high percentage of lime, even to such an extent that it is often self-fluxing. The U. S. Geological Survey estimates that ore reserves available to present-day treatment amount to 1,470,000,000 tons above the 4,500-ft. level, or enough to last 165 years at the present rate of consumption. With more refined methods of treatment, the total ore available, including about 500,000,000 tons of red ore below the 4,500-ft. level, at present is 2,045,000,000 tons, of which 75,000,000 tons is classed as brown ore.

Red ore occurs in the Rockwood formation, which is similar to the Clinton of New York and Pennsylvania, possibly being the same formation. The Rockwood measures are about 200 ft. thick, consisting of sandstone and four beds of iron ore, of which only two are now of commercial value. The ore beds are deposited over large areas and are of uniform thickness and quality. Workable beds average about 10 ft. thick and dip from 12 to 45 deg. Mining of the red iron ore was first carried on at the outcrop near the top of Red Mountain, but the overburden became so great that underground mining by room-and-pillar methods became necessary. Slopes were sunk in the ore at right angles to the strike, and from these, lateral rooms about 30 ft. wide were driven.

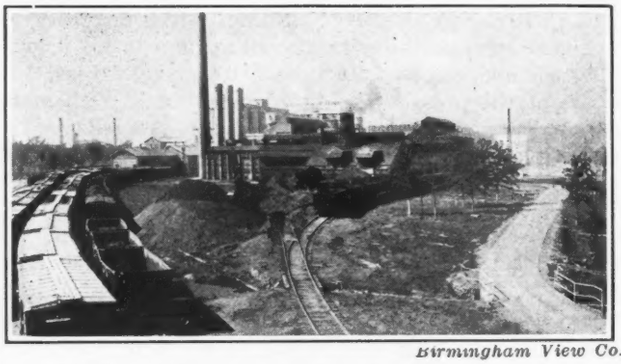
IRON-ORE MINING PRACTICE

A study of iron-ore mining practice in the Birmingham district has been made by the U. S. Bureau of Mines. The rapid development of this iron-ore district has been made possible by investigations that have led to radical changes in furnace practice. Studies of methods by which the low-grade, high-silica ores may be treated by concentration will give still greater impetus to development, states Dr. W. R. Crane,[1] in a report on the subject. Should beneficiation make available the high-silica ores of the lower bench of the Big Seam, the most important of the ore beds, mining practice must necessarily be adapted to the new conditions and will be rendered more difficult as the weight of cover increases at long distances from the outcrop. Stoping,



Plant of the Stevenson Brick Co., Lovick, Birmingham district

[1] "Iron-Ore (Hematite) Mining Practice in the Birmingham District, Ala." By W. R. Crane, Bull. 239 U. S. Bureau of Mines.



Birmingham View Co.

Plant of the Alabama Portland Cement Co., Birmingham, Ala.

handling, support, drainage, and ventilation are all affected, sometimes favorably and sometimes adversely, by the extended workings and increased depth of cover. The Bureau of Mines offers some suggestions[2] for improved and changed ore-mining practices that may be necessary with future development. The character and occurrence of the ores are discussed, and mining methods are analyzed in detail, with special reference to the support of mine workings and the handling of ore.

The drainage or water problem of the red ore mines, though not now serious, is becoming alarming as the mines increase in depth and caved areas increase. The average amount of water pumped at present is 1.43 tons per ton of iron ore. A thorough study of this situation was recently made by Dr. W. R. Crane.[3] Inasmuch as most of the water is of surface origin through mine openings, especially cave-ins, his suggestion naturally is the diversion of rain run-off.

The Birmingham district produces about 10 per cent of all the iron ore mined in the United States, and 80 per cent of the Alabama output in red ore; moreover, 43 of the 419 blast furnaces of the country are in the district tributary to Birmingham and produce 7 per cent of the pig-iron output.

There were 23 furnaces in blast on Nov. 20, 1926, 12 producing basic, 10 on foundry, and 1 on ingot mold. The Birmingham furnaces grouped by operators are: Tennessee Coal, Iron & Railroad Co., 12; Sloss-Sheffield Steel & Iron Co., 4; Republic Iron & Steel Co., 2; Gulf States Steel Co., 1; Woodward Iron Co., 3; and Central Iron & Coal Co., 1. Though 27 furnaces were in operation in 1925, the total production of pig iron in 1926 surpassed the record of the previous year, the total approaching 3,000,000 tons.

The Tennessee Coal, Iron & Railroad Co. has reconstructed all of its Ensley blast furnaces, and work has begun on two new 600-ton blast furnaces. This company recently completed eight 140-ton open-hearth furnaces, all of which are in operation. Sloss-Sheffield is also increasing its pig-iron capacity.

The Warrior River transportation service to Gulf ports is performed by barges maintained by the Mississippi & Warrior Transportation Co., from Mobile, Ala., to Birmingport, 17 miles from Birmingham. The same agency owns a short line of railway (formerly owned by the Southern Railway) from the Warrior River to Ensley. This combination gives a lower freight rate to seaboard than all-rail transportation. It is by this route that a large part of Alabama steel and coal reaches tidewater and over this route also is shipped a large amount of sugar from Louisiana to Birmingham and Atlanta, the latter city being the seat of the Coca Cola industry, wherein large amounts of sugar are used.

Water transportation places the producers of iron, steel, and coal in a position to lay their export products down at seaboard at a lower price than the producers in the Pittsburgh district. Labor is cheaper and coal and iron occur in close proximity, so that large items of freight are eliminated before the ore enters the furnace.

The Alabama Power Co. was chartered Dec. 4, 1906, and began to function as a hydro-electric power-distributing concern with only five customers and a total load of 6,500 hp. The company is one of the state's leading industrial enterprises, with more than 4,500 miles of lines extending to every section of the state and serving more than 200 cities, towns and rural communities. More than 400 major industries, 3,000 farms and rural enterprises, and 1,500,000 people living in the territory which its lines traverse are directly or indirectly dependent on its service, which emanates from steam and hydro plants having a combined generating capacity of more than 700,000 hp. and representing an investment of more than $200,000,000. Its offices and construction forces of 4,000 people are located in more than sixty cities. The general and executive offices occupy the company's own home in Birmingham, a fourteen-story structure, which is said to be one of the most imposing public-utility buildings in the world.

Development of hydro-electric power, the construction of industrial plants, and the beginning of a good-road program have resulted in a rapid development of the cement industry. The first cement plant of any importance was built at Leeds, in 1908. The demand for cement has grown by leaps and bounds, and as there is ample raw material in the form of limestone, clay, and shale in close proximity to coal, it is possible to produce a good cement at or near the place in which it is to be used. With all of these conditions so interwoven, together with the low cost of labor, there would appear to be a great field for the cement industry. Six plants, with an annual capacity of about 7,000,000 bbl.

Photo by Republic Iron & Steel Co.

Tannehill furnaces, Romp's Valley, 30 miles from Birmingham

Note: These furnaces were operated prior to and during the Civil War. In 1864 the machinery and equipment was destroyed, and the furnaces have been idle ever since. They are on the property now owned by the Republic Iron & Steel Co.

[2] *Op. cit.*

[3] "Drainage in the Red Iron Ore Mines of the Birmingham District, Alabama." By W. R. Crane, New York meeting, A.I.M.E., February, 1927.

per year, are now operating in the district. Another plant that will have a capacity of 1,500,000 bbl. is nearing completion. Alabama now produces 50 per cent of the cement consumed in the Southern states. The recent real-estate development in Florida created a large market for Alabama cement. A certain amount of cement is also made from blast-furnace slag which was formerly wasted, but is now becoming a valuable byproduct. About 600,000 tons of slag per year from the blast furnaces, operating on soft fluxing ore, is granulated and used in the manufacture of cement. A large amount of slag is crushed, screened, graded, and utilized for railroad ballast, the surfacing of highways, and as a constituent in concrete.

any shade or color, and tile of many varieties. One of the most recent plants completed is that of the Stevenson Company (80,000 brick daily), at Cordova, where a stiff-mud buff brick is produced from a clay occurring beneath a coal seam—the coal being taken out first and the clay then removed. The photograph on page 677 shows the Stevenson plant, near Birmingham, which turns out a variety of common, face, and paving bricks, and also hollow tile.

Textile Industry Now a Southern Institution

The textile industry has grown as rapidly as have mining and other industries. In 1900 31 mills were operating 411,328 spindles and 8,549 looms, compared with 85

Photo Oscar V. Hunt

Entrance to an iron mine in the Birmingham district

There are 56,500 miles of roads in Alabama, of which only 2,300 miles are of the improved type. About $10,000,000 per year is being expended for highway improvements. Ample road-building material is available in the state, whether it be gravel, crushed stone, cement or brick. Here again local natural resources produce a revenue to owners and labor alike, and at the same time, when converted to highway use, increased farm values will result. The commercial progress of the South will be measured largely by her road-building program. Without transportation systems, every village and hamlet will remain "as is."

Clay Industries Important

The Birmingham district, as well as the entire state, possesses large shale and clay deposits. It is only within recent years that the value of these resources has been realized. According to the Alabama Power Co., approximately $6,000,000 is invested in brick plants alone. These plants produce a large variety of products—refractories for furnace use, face brick of

mills, operating 1,500,000 spindles and 25,000 looms, in 1925. The cotton manufacturing industry is firmly established in Alabama, and is constantly expanding and adding new mills. One of the greatest factors in the development of this industry is an abundant supply of native white labor, largely of English, Scotch, Irish, and Welsh origin, characterized by reliability, intelligence, and a common language—English.

According to the State Board of Health, the death rate due to typhoid fever has been reduced from 39.2 per 100,000 to 14.9 per 100,000; and for malaria, from 23.1 to 10.6 per 100,000. This shows what can be accomplished when proper sanitation and good water supply are made available. About 1908 or 1909 it was discovered that a strange disease was making headway in the South, especially in the rural districts. The malady was the same as the scourge which has been known abroad for nearly two hundred years. It has been widely spread in Spain, northern Italy, Egypt, and the Balkan countries, and was there regarded as incurable. This disease is pellagra, due to malnutrition, and its

Birmingham View Co.

Underground "first-aid" room in the Birmingham district.

preventive is a well-balanced diet. The United States Public Health Service took up the study of pellagra and found at least 125,000 cases of it south of the Potomac and Ohio rivers in 1917. Alabama had many cases of the disease, but with the educational work in the schools, through county health units, and through the press its increase has been checked and the number of cases reduced to a minimum. The death rate from pellagra has been reduced from 46.8 to 15.5 per 100,000, per year. The census figures for 1920 show a death rate of 11.1 per 1,000 in Alabama as compared with 13.6 for Connecticut, 15.4 for Maine, 13.8 for Massachusetts, and 15.8 for Vermont.

The U. S. Census Report for 1920 states that foreign-born whites form only 0.8 per cent of the total population of Alabama. Including the children of foreign parents, the total foreign population is only 2.2 per cent, as compared with the foreign stock of 69 per cent in Rhode Island, 62 per cent in New York, and above 50 per cent in Illinois, Michigan, New Jersey, Wisconsin, and Massachusetts.

In the Piedmont area 93 per cent of the population is in the rural sections, and only 7 per cent urban in settlements not exceeding 2,500 inhabitants. In 1920 the state had a population of 2,348,174, of which 61.6 per cent was white and 40.4 per cent colored. Approximately the same racial conditions exist in Georgia and the Carolinas. In the so-called "black belt," the great cotton-growing area, the Negro population in 1920 was 303,558; native white, 134,594, and the foreign white, 1,403.

To the casual observer nothing has been left undone by the larger operators to make the plants safe for labor. Saws are guarded; balance wheels are housed; hand rails have been provided on all stairways and elevated walks; vertical ladders are inclosed; cross-over steps are provided over moving belts and car tracks; and many stair steps are built of concrete to prevent slipping. There are no overhead electric transmission wires in the yards of the largest operator; all wires are carried in dry underground conduits, large enough for workmen to make repairs when necessary; furnace doors are operated from a central station by an electric push button; and all loose material is kept from work floors.

At every plant or mine is a small emergency hospital to give first aid in serious cases and treatment for all minor injuries. The Tennessee Coal, Iron & Railroad Co. maintains the best industrial hospital south of the Ohio River. It has a capacity of 386 beds, with a full corps of physicians, surgeons, and nurses. It is thoroughly equipped with all modern operating appliances, X-ray machines, dental outfits and other complementary apparatus. The building is situated on an elevation 200 ft. higher than the valley, at a distance from noise, smoke, and dust. Separate wards are maintained for white and colored women, and white and colored men. There is one ward for colored children five to ten years old and one for white children of the same age. Sun parlors as well as open spaces on the roof are maintained for convalescents.

The hospital doctors and dentists visit the plant schools periodically and examine the children for various ailments such as adenoids, weak eyes, poor teeth, and contagious diseases. Each pupil has his own cup and tooth brush, to be used as one of the daily school drills. Bad teeth are filled, for which no charge is made, this being taken care of in the fee of $1.25 per month, which includes hospital services for every member of the family.

School buildings at all mines and plants of the Tennessee Coal, Iron & Railroad Co. are constructed by the company, and all teachers are paid by the county and supplemented by the company. Separate schools are maintained for the colored and white children, colored and white teachers being employed. The school work covers all grades from primary to and including the eighth grade. Manual training is required in the sixth, seventh, and eighth grades for the boys, and all the girls are given courses in domestic science, with special reference to sewing and cooking. In this respect the company is doing a great missionary and uplift service, since the children in these schools show their parents how things are done in school and in this way the older ones are reached and the good work is extended to the local community. Many of the girls' mothers go to the schoolhouse in the evenings, where they learn to use the sewing machine and to cut and make their own clothes.

Where county school facilities are lacking a number of the other companies provide buildings and pay part of the teachers' salaries.

At a number of plants restaurants are maintained for both colored and white employees, using the same kitchen, the dining rooms being separated by a partition. Good wholesome food, well cooked, is served at a moderate price of about 35c. per meal. Though there cannot be much profit in these restaurants, the service provided assures healthier, happier, and more contented laborers, which in the long run pays dividends in other ways. A discontented and dissatisfied employee can do much damage by reason of his influence upon his fellow workmen.

Although the South is much behind the industrial centers of other parts of the country in the matter of manufactures and wealth, rapid progress is being made in the right direction. The revival of this area began with the influx of outside capital accompanied by business managers and technicians who were foreign to the South. The younger generation of "native sons" is entering the domestic enterprises as superintendents, and the graduates of the local technical schools and universities are matching their skill and training with the South's natural resources.

Blende Roasting and Acid Manufacture in New South Wales

In an article entitled "Some Difficulties Associated With Blende Roasting in Conjunction With Sulphuric Acid Manufacture," published in the *Proceedings* of the Australasian Institute of Mining and Metallurgy for Sept. 30, 1926, R. J. Harvey and W. H. V. Nettle describe practice at the Cockle Creek works of the Sulphide Corporation, Ltd., in New South Wales.

Blende roasting is done in mechanical furnaces of various makes, and mostly without the aid of extraneous fuel. A hard cake or scale forms on the hearths under the rabbling teeth and on the teeth themselves. Failure to remove this results in poor rabbling across the hearths, with consequent crowding of the furnace and obstruction of the gas passages. Neglect of the hearths results in the gradual formation of scale, until the rabble teeth scrape the deposit. This means a rise in power consumption, extra strain on all the furnace running gear, and, if neglected for any length of time, may result in the collapse of the hearth.

Scale, whether on the hearths or the teeth, is removed by chisel-pointed bars, operated by hand through doors placed at frequent intervals round the periphery of each hearth. This barring is carried out twice per shift on the main roasting floors, and at least once in sixteen hours on other floors. The finer the zinc concentrates being treated, the more attention the hearths require. Another place where scale is formed is in the gas offtake, a cast-iron bend leading out of the top hearth of the furnace, which necessitates attention every eight hours. The presence of this flue scale in the furnace is undesirable, being largely zinc sulphate, which becomes very sticky and clings to the furnace rabble teeth.

Partial Analysis of Scale From Furnaces

	Gas Offtake, Per Cent	First Hearth, Per Cent	Third Hearth, Per Cent	Sixth Hearth, Per Cent
Zn	36.6	32.4	31.4	30.0
Pb	5.9	7.8	5.6	4.4
S	13.2	13.9	13.5	10.3
S as SO_4	13.1	13.7	13.2	9.7

An interesting formation found in the furnace is secondary galena. This is found as a hard cake on the top of the chrome-steel hearth bricks and at times on the side of teeth. The deposit forms such close contact with the steel bricks that ordinary furnace barring seldom disturbs it. Cakes 2 in. thick have been removed with hammer and chisel after dismantling a furnace.

The tenor of the gas supplied to the acid plants is a matter of grave importance to the operator. It is unfortunate that the limit with Barrier zinc concentrate is 5.5 per cent sulphur dioxide; above this the furnaces become sadly overheated, and the resultant production of lead sulphate fume is enormous. The critical temperature is 900 deg. C., and this should not be exceeded. Experience has shown that high-tenor gas, high temperatures, and volatilization of lead go hand in hand. The maintenance of this gas tenor is a difficulty which shows in the variations in the acid chambers rather than in the actual gas assay.

The barring, done through furnace doors, upsets draft conditions by the admission of extra air, to say nothing of the effect of the extra stirring up of the bed of concentrates and increased release of sulphur.

So many are the possible sources of trouble that the whole layout must be most carefully considered, wherever possible in the light of past experience rather than of theoretical consideration. The evidence so far accumulated is in favor of decentralization; that is, each acid plant to have its own furnaces, which should be as close to the Glover tower as practicable.

Dust deposited in the gas mains before the cyclone dust collector is removed by means of a "pull-through." This is operated by two winches, one at each end of the gas main. The "pull-through" is drawn backward and forward once in twenty-hour hours, the dust falling to the ground through 9-in. pipes situated every 10 ft. along the bottom of the flue. The bottom of each pipe is open for about fifteen minutes during cleaning. This admission of cold air to the gas system is most undesirable to the acid manufacturer. By a simple device of two slides, one at the top and the other at the bottom of the down pipe, this can be obviated.

The method of removing lead sulphate dust is by a weekly stop of two hours. All gas flues after the cyclone dust collector, including the gas distribution box and gas main to the acid plant, are cleared out during this stop. Doors are provided on the top and bottom of the gas mains, and men scrape the lead sulphate on to the ground; it is then removed to the calcine stock bin.

The authors conclude that eventually the contact process for acid manufacture, which requires clean, pure gas, will offer the best field for utilizing blende gas. The tenor of gas in this process, and the variations, are not so productive of trouble. The most serious loss is unconverted sulphur dioxide, whereas in the chamber process the niter recovery train is easily upset, and a few hours may cause much loss of a valuable reagent. It may be, however, that when using blende gas in chamber plants a partial purification of the gases (something less than is necessary for the contact process) may be the means of improving matters from the acid maker's point of view. The provision, for instance, of lime towers at no great capital cost might effect sufficient purification, particularly as concerns the halogens.

Importance of Diamond Drilling

Mining engineers have learned not only that mines may be discovered by the use of the core drill, but also that they should be thoroughly explored with this drill before they are opened; otherwise time and money may be wasted, says Frank A. Edson in U. S. Bureau of Mines Bulletin 243. For example, the Uno mine on the Mesabi iron range was opened before it was thoroughly drilled; after the stripping contractors had removed more than two-thirds of the overburden it was discovered that there was a large area of barren rock in the center of the proposed open-pit mine. Some ten or fifteen drills were immediately moved to the mine and the extent of the barren formation was determined. The entire plan for the opening up of the mine had to be redrafted. Numerous incidents of this kind have convinced mining engineers that a property should be thoroughly drilled before an attempt is made to open it.

In many mines diamond drills are used underground to prospect ahead of the drifts, or if a fault or a slip has cut off the ore, to find the ore again. The mining industry has learned to place great dependence on the results of diamond drilling. Frequently mining properties are bought and sold on the basis of the findings of the diamond drill, and such transactions often involve several million dollars. The core drill is most accurate where the ore or mineral sought occurs in large masses of fairly even composition; it finds so-called blanket or sheet deposits most easily.

On Ore Magmas—II*

By J. H. L. Vogt
Trondhjem, Norway

On Veindikes

AS AN example of veindikes I take the before-mentioned Norwegian pyrite deposits of the type Röros-Sulitjelma. From a series of observations we conclude that these deposits have been formed by the injection of a very thin fluid sulphide magma, carrying some dissolved H_2O, etc., segregated from a gabbroidic magma and injected at a very great depth and at a dynamometamorphic pressure.

Referring to my summary in Beyschlag-Krusch, Vogt, Die Erzlagerstätten (I, 1910; II, 1914), I emphasize that the sulphide magmas, not following tectonic fissures, were *laccolitically* pressed in along the strata, often with a rather flat dip of the schistose rock, in numerous cases following the exact boundary between a light schistose rock and a more compact rock, the latter in most cases forming the hanging wall. In the schists, close to the boundary of the deposits, we often meet with small slips and folds, due to the pressure caused by the intrusion of the sulphide magma. Angular fragments of the wall rocks sometimes occur within the sulphide deposits. And the characteristic ruler-and-stick form—a length such as 1,200-1,500 meters—in places even more than 2,500 meters, with a breadth only 75, 100, 200 meters and a depth of some few meters, and the parallelism at several places stated between the longest direction of the ore deposits and the folding axis or the stress axis of the schistose rocks, may be explained by the laccolitic injection at a dynamometamorphic pressure. For these deposits Spurr's new term veindike is excellent.

As to the tectonics of these sulphide magma deposits, we may word for word apply Spurr's characteristic of the quartz magmas[17].

"The intrusions did not find spaces which they filled, they shoved and shouldered their own way in, pushing aside the shaly rocks, selected for invasion because the weakest of the sedimentary series."

On Ore Deposits Due to Gaseous (Including Fluid) and Hydrothermal Processes Connected With the Magmas

As to the physicochemical laws of the escape of the volatile compounds dissolved in the magma, I refer to a summary, especially based on Niggli's publications and on a lecture by Th. Vogt (April 16, 1920) in the Academy of Science in Oslo, which I have given in *Economic Geology*, Vol. XXI, 1926, pp. 213-224.

In my opinion most ore deposits connected with the eruption of igneous rocks are due to the gaseous (including fluid) and hydrothermal processes, connected with the magmas. Spurr completely underrates the significance of the last-named processes. In his presidential address to the Society of Economic Geologists, delivered in May, 1922,[18] Spurr quoted from a previous paper (1910) by myself:

"In addition to these magmatic segregations, the pneumatolytic and the contact-metamorphic deposits must also be considered, both in genesis and in space, as occurring in close relation to eruptive magmas. There is this difference, however, that while the magmatic segregations result from a single process, that of magmatic differentiation, in the case of the other deposits the metal after such differentiation was taken up in aqueous or gaseous solution and deposited later by other processes. It is natural, therefore, that in the majority of cases the magmatic deposits are quite distinct from the related pneumatolytic and contact-metamorphic deposits."[19]

And Spurr continued:

"I [Spurr] quote this last not because I agree with the deduction made, but because I disagree. . . . I [Spurr] differ sharply from him (Vogt) . . . in his distinction between magmatic segregations on the one hand, and pneumatolytic deposits on the other."

It is impossible in a short paper to discuss all the differences touched on here. I shall only treat some few, indeed crucial, points.

On the Genesis of the Pyrometasomatic ("Contact-Metasomatic[20]") Ore Deposits

According to Spurr, the "normal" contact-metamorphism should be due to the "hot magmatic waters or gases," escaping from the magma. And the so-called "contact-metasomatic" or pyrometasomatic ore deposits, occurring only at places, should depend on an "ore injection" . . . "clearly due to concentrated and highly localized magmatic differentiates—ore magmas" . . . "These ore magmas, like other magmatic differentiates, only collect together where conditions are favorable for this and other manifestations of magmatic differentiations, in what I [Spurr] have called the zone of differentiation—a zone whose depth is variable."

As stated by V. M. Goldschmidt in his excellent paper in the Society (now Academy) of Science in Kristiania (Oslo, 1911), the mineral association within the rocks of the "normal" contact-metamorphism is a function of the original chemical composition of the rocks and may be explained by the physicochemical laws. In my opinion, which I share with many other investigators, this "normal" contact-metamorphism is a *purely thermal* process, due to the reactions in the *solid* phase, and this process may be explained without regard to hot gases escaping from the magma.

As to the pyrometasomatic deposits, there can be no doubt that their metallic contents are due to a supply from the magma itself.[21]

As to the numerous, but indeed rather small, deposits within the contact zones of the Kristiania (or Oslo) igneous rock, I many years ago (1884, 1892) laid stress on the fact that many of the deposits occur within the Silurian strata (according to V. M. Goldschmidt limestones, often rich in common schists) *immediately* at the igneous contact, and a remarkably great number occur within Silurian *xenoliths*, sometimes only a few meters

*Second and final installment. Part I appeared in the April 16 issue.

[17]"The Ore Magmas," Vol. I, 1923, p. 94.

[18]*Econ. Geol.* Vol. XVIII, 1923.

[19]If writing now I would to some extent use other terms to express the same ideas.

[20]The old term "contact-metamorphic" or "contact-metasomatic" deposits not being a good one, I adopt Lindgren's new term "pyrometasomatic."

[21]I refer to the chapter on the "contact-deposits" in Beryschlag, Krusch, Vogt (second edit., 1914), where a summary of the observations and also a quotation from the literature is given.

long and sometimes greater, which are imbedded in the igneous rock. As the ore, especially the iron ore (magnetite), at these localities or small mines is deposited exclusively within the xenoliths themselves and not also within the igneous rock, I draw the conclusion, that the metal (iron) had been transported from the magma as a vapor.

Referring also to the many other observations in my old papers on this subject and in the explicit work of V. M. Goldschmidt we must conclude[22] that *the escape of the iron-bearing gases took place either just at the beginning, or at a very early stage, of the solidification of the magma.* And V. M. Goldschmidt has further pointed out that *the exhalations of the compounds of copper, lead, and zinc are younger than those of iron.*

The arguments given by Spurr do not shake the justification of this conclusion.

P. Niggli, in his "Versuch einer natürlichen Klassification der im weiteren Sinne magmatischen Erzlagerstätten,"[23] mentions that it would be illogical to admit the so-called pyrometasomatic deposits to the value of a separate class. For this reason he connects the pneumatolytic metasomatic deposits (the "contact-deposits") with the pegmatitic to pneumatolytic vein-like deposits.

To take the pyrometasomatic iron-ore deposits as the typical representatives of the one kind of deposits, we here meet with:[24] predominant iron, often some manganese, sometimes traces of zinc, copper, lead, etc., but no tin at all, not even in traces; further, the mineral association garnet, especially andradite (lime-ferric oxide garnet), augite (often a hedenbergitic diopside, rich in Ca Fe Si_2O_6), hornblende, ilvaïte, biotite, epidote, vesuvianite, calcite, and subordinate quartz. Boron minerals (tourmaline, etc.) have been found at some deposits; as a rule, however, only as mineralogical curiosities, and they are entirely or almost entirely lacking in most localities. Fluorite is sometimes present, but, like other minerals carrying fluorine, on the whole is rather scarce, often occurring only in traces or being entirely absent. And the chlorine-containing silicate, scapolite, is, when present, as it sometimes is, almost without exception subordinate only.

As the representatives of the other kind of deposits we take the veins and impregnations of cassiterite, in Saxony, Cornwall, Mount Bischof, in Tasmania, etc.: Predominant cassiterite, often some wolframite, molybdenite, arsenopyrite, and sulphides of copper, lead, zinc, etc.; but on the other hand, iron, the heavy metal incomparably the most widely distributed in the earth's crust, in this class of deposits receding into insignificance; further, the mineral association quartz, fluorite and other *fluorine*-bearing minerals, tourmaline and other *boron*-bearing minerals, beryl, apatite, etc.

The tinstone veins and impregnations, traversing the granite sometimes even to a depth of about 1 kilometer, must have been formed by a process of "gaseous" extraction within the granite magma at a *far advanced stage* of the solidification. To support this conclusion we mention that many of the characteristic minerals (cassiterite, topaz, beryl, Li-minerals, etc.) sometimes also occur within the granite pegmatites. And at some localities (Pitkäranta, etc.) where both kinds of ores and mineral associations are combined, the minerals of the cassiterite group are younger than those of the pyrometasomatic group.

The difference between the two extreme groups may depend on the metallic compounds of the pyrometasomatic group being extracted at an *early*, those of the cassiterite group on the contrary at a *late*, stage of the solidification of the mother magma (at the cassiterite group exclusively a granitic magma).

The extraordinarily high contents of fluorine (and boron) of the cassiterite deposits, and on the other hand the subordinate quantity and in many cases even the complete lack of halogens[25] (and boron) at the pyrometasomatic deposits, prove that fluorine (H F, etc.) must have been the decisive factor in the magmatic extraction of the cassiterite deposits,[26] and that, on the other hand, the magmatic extraction of the pyrometasomatic extraction is not due to halogens, but to other compounds[27] (H_2O, CO_2, etc.).

In a genetic classification of the numerous deposits due to a "gaseous" magmatic extraction the pyrometasomatic deposits in my opinion may be given a separate place, in line with the Sn-W-Mo-Be-Li-B-F deposits and the many other deposits due to the same kind of processes.

On Ore Deposition Formed Either From a Stagnant, Rather Concentrated Solution or From Mobile, More Dilute Solutions of Varying Compositions, and Ascending During Long Geological Periods

A crucial point in Spurr's new doctrines is that

> "'. . . many veins of copper, zinc, lead, and the like' have been 'deposited from highly concentrated magmas' which appear in many cases to have intruded the rocks under pressure, such as does an igneous dike. These relatively concentrated solutions I called *ore magmas*, dividing them into relatively dry and relatively aqueous classes. Yet even the aqueous ore magmas . . . , according to my conclusions, are relatively highly concentrated metallic solutions, and are quite different from the mineralizing waters which I have hitherto pictured as the ore carriers in the case of copper, lead, zinc, and such metals."

Spurr makes an exception as to cinnabar, realgar, and some other ores, including a certain group of gold ores, but the majority of the veins of copper, zinc, lead, and the like should have been deposited from "ore magmas." I cannot agree with Spurr's use of the term "magma" in this connection, yet this is a question of inferior importance. The cardinal point is the question, if we have to deal with a deposition either from dilute and varying solutions, ascending during long periods, or from a rather constant and stagnant, more concentrated solution, injected at once or by a single process. This solution, according to Spurr, must be rather viscous, and in many cases it must be a gel. This last supposition seems, however, not to be an essential point in Spurr's doctrines.

As representatives in Europe of the veins in question we take Freiberg-Schneeberg, in Saxony; Clausthal-Andreasberg, in Harz; Przibram, in Bohemia; and

[22] See my paper in *Econ. Geol.*, Vol. XXI, 1926, p. 316-319.
[23] Abh. zur praktischen Geologie und Bergwirtschaftlehre," I, 1925.
[24] As to the following explanation, I refer to my paper in *Econ. Geol.*, Vol. XXI, 1926.
[25] See Beyschlag, Krusch, and Vogt, Die Erzlagerstätten, 2d edit., I, 1914, p. 382, and several papers of P. Geijer, recapitulated in *Econ. Geol.*, Vol. XX, 1925, p. 687.
[26] I refer to the physicochemical explanation given in my paper in *Econ. Geol.*, 1926, p. 222 et seq.
[27] According to the studies of Smith, Niggli, and others, the fluid phase say of H_2O, at a supercritical temperature and high pressure, may carry in solution not only light volatile compounds, but also other compounds, such as Fe_3O_4, Fe CO_3 (or Fe $H_2(O_3)_2$) etc. The old idea, that iron in the "vapors" producing the pyrometasomatic deposits might have been extracted and transported as rather light volatile compounds, such as Fe Cl_2, Fe Cl_3, cannot longer be maintained. I refer to a short summary concerning the recent investigations on the problems in question, given by W. F. Foshag in *Econ. Geol.*, Vol. XXI, 1926, p. 194-197.

Kongsberg, in Norway. Within the same vein we often meet with the well-known symmetric banded structure, composed of a series of zones of minerals, following after each other and often with a repetition of the same mineral (e.g., blende, galena, quartz, calcite, barite, and calcite—this last mineral sometimes in several different crystal habits), and with the crystals of the minerals attached to wall, inclusion, or pre-existing mineral. This phenomenon has long ago been explained by a crystallization from solutions of *varying* compositions, and it cannot be explained by a rhythmic, pulsating deposition from a standard solution.

Taking the numerous "Gangformationen"[23] in Saxony, each "Gangformation" of a given geological age, as an example, it has long ago been stated that the filling of these veins continued during long geological periods.

On the basis of these and many other observations the German school[24] as early as the middle of the nineteenth century concluded that the filling of the veins were due to *hydrothermal* solutions, derived from an "unknown depth," within each vein fissure at *the various stages of varying compositions* and *the filling continued during long geological periods.*

This is a short summary of the old German "hot-water" school, and the genetic conclusion as to the veins considered here has in the principle been confirmed by many investigations of more recent date.

I quote from Spurr:

"The two opposite schools of thought, which we may call the lateral-secretion school and the 'hot-spring' school, both ascribe the deposition of ores to the agency of circulating water, whether atmospheric or juvenile. Sharply defined from both these opposing theories is the theory of magmatic differentiation, first proposed, so far as I know, by J. H. L. Vogt, of Christiania, in 1893. The idea of magmatic differentiation of rocks dates as far back as Scrope in 1825."

[23]The translation "vein formation" gives no complete conception of the German term.

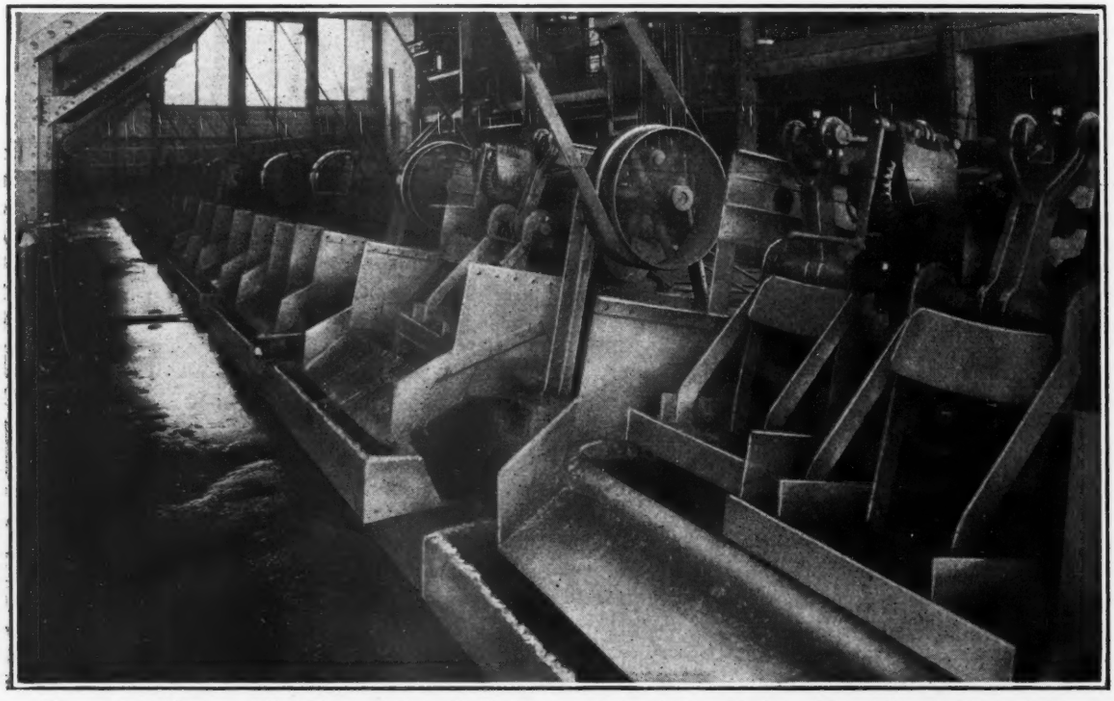
[24]I refer to the historical review give by K. Hummel in *Econ. Geol.*, Vol. XX, 1925, p. 495-499, and by myself in the same journal, XXI, 1926, p. 469-471 (written in the spring of 1924).

In my opinion there is, however, no opposition between the "hot-spring" school and the theory of magmatic differentiation. I am myself an adherent of both schools or theories. The old German "hot-spring" school left the problem of the original source of the metals in the "unknown depth" an open question. The magmatic differentiation school tries to advance further toward the solution of the problem.

We have determined the formation of several classes of ore deposits by various processes of liquid magmatic differentiation. As to other classes of ore deposits we have determined a formation by an extraction of the metallic contents in the magma due to the dissolved volatile compounds. And as to still other classes of ore deposits, we may also conclude that the metallic contents have been derived from the original rock magmas, and probably as a rule from the residual magmas, but in what manner the magmatic extraction has taken place may be left to future investigations.

Value of Core Drill in Prospecting

The value of the core drill in prospecting is well known and, according to Frank A. Edson in U. S. Bureau of Mines Bulletin 243, many mines have been discovered by it. Most of the iron mines of Minnesota and Michigan have been explored by drilling rather than by sinking shafts and driving drifts. Gold was found in the Rand, South Africa, at depths of over one mile with the aid of the diamond drill. The diamond drill also has been extensively used in exploring and developing the coal and potash deposits of Europe. The finding of the Cuyuna iron range in north-central Minnesota is a good example of diamond-drill prospect work. This range is entirely buried under a mantle of glacial drift, the nearest outcrop of solid rock being nearly 40 miles away, yet several hundred million tons of ore have been discovered in these deposits by the method of exploration described.



Drag classifiers at the Consolidated Mining and Smelting Co.'s mill at Kimberley, B. C.

The Myth of Eldorado

By T. A. Rickard

THE STORY of the early Spanish and the subsequent English search for treasure in the New World is typified by the myth of *El Rey Dorado*, the gilded king, from which we derive the word "Eldorado" as a synonym for mineral wealth. After the extraordinary happenings in Mexico and Peru, the adventurous spirits of the time, in Spain, in England, in Flanders, and in western Europe generally, were ready to believe anything; it was the age of marvels.

When the *conquistadores* had invaded and devastated not only Mexico and Peru but also Panama, Guatemala, Venezuela, and Colombia (then known as New Granada), they looked around for fresh sources of wealth in a spirit of eager optimism; any wild rumor to them was a fact. In 1535 a roving Indian first told the tale of the Gilded King to Sebastian de Belalcazar, a lieutenant of Francisco Pizarro and the conqueror of Quitol.[1] Somewhere in the mysterious interior of South America there was a chieftain that was gilded, as part of a religious rite; he stood on a raft in a lake while his body was smeared with oil or resin, over which, it was said, powdered gold was spread until he appeared resplendent in the sun. It is probable that the gilding was done with spangles of mica. According to another account, the chief plunged into the water, which removed the metallic covering to enrich the bottom of the lake; and while he was performing thus, the assembled company threw golden jewels into the water as an offering to the goddess of the lake, this goddess being an early chieftain's wife, who threw herself into the water to avoid a punishment. At first the site of this performance was placed somewhere not far from Bogotá, but later it was identified with Lake Guatavitá. The ceremony ceased to be performed in about 1470, when the Guatavitá Indians were conquered by the Muyscas of Bogotá, but the legend survived and eventually reached the ears of the greedy Spaniards[2].

Sacrificial Offerings Sought

In later years the natives living on the shores of this lake retained the belief that their deity lived therein, in consequence of which they sacrificed gold and emeralds to him. This fact being known, an attempt was made in modern days to drain the lake, and during these operations a few golden ornaments were fished up from time to time, but not enough to destroy the cheerful conviction that an immense treasure still lies on the bottom of the lake.

One of the first to pursue the phantom was Gonzalo Pizarro, who in 1541 led an expedition from Quito across the mountains into the valley of the Amazon. The attempt proved disastrous. Torrential rains and repeated earthquakes left the adventurers weary, hungry, and terrified; they lost all their livestock, and of the 4,000 Indians that started with the expedition as porters not one returned to Quito[3]. Less than half of the Spaniards survived the hardships of the journey. They reached a tributary of the great river, and built a boat, on which subsequently Francisco Orellana made his famous voyage down the Amazon. This name, Rio de las Amazonas, is derived from one of the many fanciful stories that Orellana told when he reached Spain to magnify his exploits. He had a skirmish with a tribe of Tapuya savages whose women fought alongside the men, as was the custom among the Tapuyas[4].

Other phantom-chases followed in the course of the years. At first the adventurers in search of *El Hombre Dorado* sought him in the valleys of the Amazon and the Orinoco, then in the territories watered by the Pilcomayo and the Paraguay. It was all in vain; their lure eluded them. Many lives and much real money were squandered, only to meet with suffering and disappointment.

The Quest of the Golden City

Meanwhile another and separate myth had arisen like a miasmatic mist over the tropic lands of the great river-valleys in the northern parts of South America; it was the tale of the Golden City of Manoa. Among the first to seek this fabulous place of treasure were sundry German knights under the patronage of the Emperor Charles V. The Spanish emperor had leased the province of Venezuela (or "little Venice"—so called because the discoverer, Ojeda, in 1499, found a village built on piles) to the house of Bartholomäus Welser & Co., of Augsburg, and it was under these auspices that in 1529 Ambrosio de Alfinger, at the head of a Spanish expedition, started for the interior from the coast at Coro. He became infamous for his cruelty to the natives, and met a just fate, for he was mortally wounded in a fight with the Indians at the headwaters of the Magdalena River. A remnant of his followers found their way back to the coast, worn out and crippled with disease. They had seen enough gold to keep the myth alive, for 60,000 dollars in booty was sent back to Coro, the port of departure, and the expedition had found the Indians in plentiful possession of golden ornaments. In consequence, a few years later, in 1536, another German, named George de Spires, resolved to make the attempt to penetrate this rich region. He left Coro with 300 foot soldiers and 100 mounted men; and these also faced hardships and dangers that would have stopped anyone less enthusiastic than were these intrepid freebooters of the Spanish main. They reached the upper waters of the Guaviare and traversed an immense extent of country, but fruitlessly, so that after three years of courageous wanderings they had to return discomfited[5]. Meanwhile, Nicholas Fedreman, who had followed George de Spires with supplies and reinforcements, had been prompted by personal ambition to start on an adventure of his own, and after three years of unproductive search he had reached Bogotá, where he met the Quesada brothers, who had conquered the country of the Chibchas and founded New Granada. There the Spaniards amassed prodigious wealth from the sacking of the "cities"—that is, the Indian adobe villages. At Tunja, for example, they gathered 228,000 dollars'

[1] "The Quest of El Dorado," by J. A. Zahm, p. 37.
[2] A. F. Bandelier: "The Golded Man," p. 15.
[3] William Robertson: "History of America," Vol. III, p. 201.
[4] Orellana did not discover the Amazon, this being credited to Vicente Pinzon, in 1499. He thought he had reached the Ganges.
[5] Clements R. Markham's introduction to Bodaert's translation of Pedro Simon's "Sixth Historical Notice of the Conquest of Tierra Firme."

worth of gold, and a dollar then in Europe had a purchasing power at least ten times what it has today. Fedreman went with Hernando de Quesada in search of "the house of the sun," the fabled treasure city. The members of this expedition endured appalling hardships in the land of the Musos in the Amazon valley, and lost half their number before they returned, defeated in their purpose, to Bogotá.

Even that did not stop the search for the mirage of gold. In 1541 Philip van Huten, a companion of George de Squires in his previous expedition, started from Covo at the head of a large body of gallant cavaliers. They reached the Cordillera and were told by an Indian of a land rich in gold and silver, in proof whereof he showed them some apples made of gold and silver, which he said his own brother had brought from the wondrous city of Macatoa. The Indian accompanied them as guide for a few days and then disappeared. This expedition also suffered terribly from sickness and hunger, and lost its way completely, so that a whole year elapsed before it reached the land of the Uaupe tribe on the Guavaire River.

The Spaniards then advanced into the territory of the Omagus, reputed to be rich in gold, and attacked them wantonly, with unfortunate results, for they suffered defeat and their commander, Van Huten, was wounded. He lived, however, to return, with the remnant of the expedition, to Covo, on the Venezuelan coast, where he was beheaded by the brutal governor, Carbajal. That ended the treasure hunt from the side of Venezuela, but the myth was not yet exploded, and the Golden City of Manoa was still a day dream of the Spanish adventurers.

URSUA'S EXPEDITION ENDS IN HIDEOUS CRUELTIES

Next comes the story of Pedro de Ursua, a knight of Navarre, who led an expedition across the Andes from Peru in 1559, the spur to this exploratory adventure being a story told by a Brazilian chief who stated that on his way across the country from Brazil to Peru he had passed through a land rich in gold. The information was scanty and would be unconvincing to those not ready to swallow any yarn of this kind, but it sufficed to stimulate renewed search in the wilderness of the upper Amazon. Ursua was accompanied by a number of men of bad reputation, and they behaved accordingly, for he himself was murdered when the expedition, on boats, was descending the Amazon, and his successor in the command shared a like fate, these crimes being instigated by one of the most bloodthirsty villains to be found in history. He was Lope de Aguirre, who led his troop of desperadoes from the Amazon into the Orinoco, and thence to the island of Margarita, to end in the swamps of Venezuela, where he was killed in 1561, but not before his trail had been marked by a series of murders, assassinations, and cruelties so hideous and so horrible as to stamp him an inhuman monster. Nevertheless, he was intrepid, as is proved by the extraordinary character of his exploration.

That gruesome adventure ought to have ended the mad search for the will-o'-the-wisp of the gold-seeker's fevered fancy, but it did not. Several other courageous but foolish men led others equally foolish into the wilds, there to die of disease or to be killed in useless skirmishes with the natives. By this time the *Rey Dorado* and the *Gran Laguna de Manoa* had found a resting place in the morasses of Guiana, so it is not surprising that Sir Walter Raleigh, when he caught the same old gold fever, went thither in quest of his Eldorado.

Raleigh had read about the wondrous golden regions in the Spanish tales of the *conquistadores*, and by them he was prompted in 1595 to lead an expedition that went to Trinidad for the purpose of ascending the Orinoco in search of the fabled gold. Upon arrival in Guiana he was regaled with many marvelous yarns, all of which he swallowed eagerly; he enjoyed a romantic voyage up the river and a rapturous wild-goose chase after the figment of the chronicler's imagination, but his excursion was brought to an abrupt end by the approach of a large Spanish force, which he was in no condition to oppose because he was short of ammunition. He returned to England, where he became the butt of ridicule, to allay which he wrote a book describing his travels[4]. As author of that book he signed himself "Ralegh." In the course of his description he quoted Ribeiro's account of the Amazons, who possessed gold and silver in plenty, "their seats and all the utensils in their houses being made of them." It was fitting that the old myth of the Amazons, repeated by Homer and Herodotus, by Pliny and Plutarch, should have been resurrected, and that it should have given its name to the great South American river along which the deluded adventurers of a later time pursued the phantoms of their own imagination.

The first Amazons are supposed to have lived in Pontus, near the shore of the Euxine, from which they made warlike excursions into the neighboring territory. No men were permitted among them, except once a year for a short period, when, to prevent the extinction of their race, the Amazons visited the Gargareans, a neighboring tribe. In the later stories the men were allowed to pay them a visit. The origin of this myth may be found in the first contact of bearded men with a people among whom the men were either beardless or clean-shaven. Again, such a story might arise from a real revolt of the women, or it might be explained by the fact that the women of the Tartar tribes traveled on horseback with the men, and went into the fight with them. Whatever the explanation, it is a fact that the tale of the Amazons appears almost as frequently in the old chroniclers as that of the Gilded King.

COPPER-GOLD METALLURGY AS RECORDED BY RALEIGH

According to Raleigh, the gold was obtained in nuggets "as big as small stones" in the lake of Manoa and in the rivers of that country. The natives, he says, "put to it (gold) a part of copper, otherwise they could not work it, and they used a great earthen pot with poles round about it, and when they had mingled the gold and the copper together, they fastened canes to the holes, and so with the breath of men they increased the fire until the metal ran, and they cast it into moulds of stone and clay, and so made those plates and images"[5]. This description, taken from the old Spanish chronicles, agrees with the information available concerning the crude method of smelting in vogue among the Mexicans at the time of the conquest; for example, Juan Diaz, in recounting the story of Juan de Grijalva's expedition to the Mexican coast in 1518, says that the Indians brought gold that had been cast in bars. "Our men," he says[6],

[4] "The Discovery of the Large, Rich and Beautiful Empire of Guiana," by Sir W. Ralegh, Knt. Edited by Sir Robert H. Schomburgk.

[5] *Op. cit.* The spelling has been corrected, to make the quotation easier to read.

[6] "The Itinerary of Grijalva," by Juan Diaz, translated by Marshall H. Saville.

"asked them for some native gold, and the Indians showed them some and told them it came from the foot of the coast range, because it was found in the rivers which had their source in the mountains. An Indian could leave here and reach the source of the gold at mid-day and have time before dark to fill a reed as thick as a finger. In order to get the gold they had to go to the bottom of the water and fill their hands with sand in which they searched for the grains, which they kept in their mouths.

"The Indians melted the gold in a crucible, in whatever place they found it, making use of cane reeds as bellows to light the fire. We saw them do this in our presence." This is interesting, as an exhibit of the most primitive forms of mining and smelting.

THE END OF THE TRAIL

Raleigh was not content with one abortive effort; twenty-one years later, in 1617, when he was sixty-three years old, he started again on his foolish quest, only to fail miserably and ruin himself in health and pocket. But the phantom "whose maw was never sated with the souls of heroes" did not vanish, and others faced fevers, famine, and fierce savages in the insane effort to catch it. Thousands died in vain. Even as late as 1775 the Governor of Spanish Guiana sent an expedition in quest of *El Hombre Dorado*, this time supposed to be resident on Lake Parima. Only one man returned alive. The myth was killed at last.

Forty years ago when riding over the pine-clad foothills of the Sierra Nevada in Calaveras County, California, I lost my way; and in the effort to retrace my trail I rode into a deserted mining camp, the name of which, in large letters, was printed on a board nailed to a tree: *Eldorado*. I had found it! Among the ruined huts were two or three Chinese coolies engaged in washing the gravel of a bubbling stream in which there were more trout than nuggets of gold. The Gilded King had become an impecunious Mongol!

An Australian Antimony Smelter

In the Dec. 6, 1926, issue of *Chemical Engineering and Mining Review*, J. H. McLean describes the antimony smelter at Costerfield, Victoria, Australia, recently closed down on account of lack of ore.

Hand-picked ore, containing over 60 per cent of antimony, was smelted direct. Lower-grade ore was concentrated by Harz jigs, Wilfley tables, and Minerals Separation flotation machines, the concentrates varying in size from 4 in. to 60 mesh. These were fed into a shaft furnace of the oxidizing unit of the smelter. This furnace was built of firebrick, was 4 ft. x 4 ft. square and 19 ft. high, and was charged to about 1 ft. below the feed door, with coke, on which the concentrates were thrown. Induced draft sufficient to draw off all the antimony trioxide formed was produced by a centrifugal blower which was placed halfway along the condensing unit.

The oxide collected in the first two chambers was an indication of the correct working of the furnace, for, if too high a temperature was reached, some of the Sb_2O_3 was converted into Sb_2O_4. This non-volatile antimony tetroxide settled on the floors and walls of these chambers as hard, heterogeneous, crystalline crusts, in large amounts if a high temperature was maintained for long. On account of the large cooling surfaces available in the U-tubes, cyclones, and stacks of the condensing unit, and the rate at which the oxide was drawn off from the furnace, it was deposited in big needle crystals approximately 0.5 in. long, which were very light and clung together, forming a mass-like flock. At the stack of this section of the plant a continuous stream of white fume could be seen while the furnace was working. This could have been prevented by placing a baghouse in the condensing unit, but as it would have restricted the output of the furnace, and as the loss incurred was small, its erection was not warranted. In dry weather, the oxide collected from this plant was a good white, but, when the furnace was fed with wet coke, the chambers were covered inside with a red deposit up to a thickness of 4 in. of oxide superficially covered with antimony trisulphide. The chambers were cleaned out once a week, and the oxide was taken to the starring furnace or oxide re-treatment plant.

The oxide to be reduced to metal was charged into a reverberatory smelting furnace fired with slack coal, the reduction being brought about by mixing sawdust with the charge. A small quantity of soda ash was added to form a protective layer of slag over the hearth of molten metal and to prevent excessive oxidation. When the hearth held about five tons of metal, the slag was drawn off with rakes and skimmers and a charge of starring slag thrown in. This slag had been used for a previous run and was freshened up with a small amount of soda ash and stibnite.

The composition of a typical starring slag is as follows: Sb_2S_3, 4.13 per cent; Sb_2O_3, 69.52; Na_2O, 17.65; "insoluble," 8.70.

The starring slag fused between 700 and 800 deg. C., and when melted was ladled out with the molten metal into 56-lb. molds and slowly cooled. The ingots were chipped and brushed clean of slag with steel wire brushes, inspected, and marketed. The slag from this operation was kept for the next run.

An analysis of A.S.P. star antimony showed: Cu, nil; Sn, nil; Pb, nil; As, 0.09 per cent; Fe, 0.01; Bi, nil; Sb, 99.80 per cent.

The oxide re-treatment plant was somewhat similar to the oxidizing unit but much smaller. The furnace was a small circular cupola with four tuyères at the top of the hearth and two more admitting air to the top of the charge above the feed door. The condensing section of this plant consisted of a firebrick and red brick chamber, a cyclone, and a baghouse with a centrifugal fan placed in the circuit at the intake of the baghouse. The oxide with a small amount of reduction slag from the starring furnace was charged into the furnace on a bed of burning coke, where it soon volatilized. The cooling of this oxide took place very rapidly, so that it was deposited mostly in the amorphous form as very small spheres.

A small amount of crystalline oxide was also collected at the cyclone. The baghouse product was the most suitable as a pigment on account of the fine state of division of the particles, which were approximately 0.0025 mm. in diameter, and because of their spherical form and whiteness.

The clinker from the shaft furnace of the oxidizing unit contained the gold concentrated from the furnace charges, and assayed from 6 to 8 oz. of gold and 2 per cent of antimony per ton. This was shipped to St. Helens, at Liverpool, England, for extraction of the gold contained.

Osmiridium Mining in Tasmania

By Percy O. Lennon
Royal Colonial Institute, Northumberland Avenue, London W. C. 2, England

EIGHTEEN MONTHS have now elapsed since the discovery of the productive osmiridium field on the Adams River, Tasmania. This field is in the wild and little-known west part of the island. The osmiridium, as in other parts of Tasmania, is obtained in a "free" state in the alluvial wash and detrital matter near intrusive belts of serpentine rock, from which it originally came.

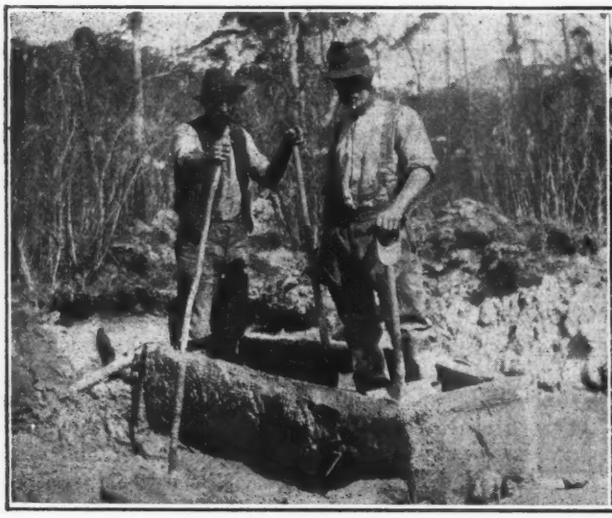
Much of the metal at Adams River is found in white sandstone quite a distance away from the serpentine outcrops. As there is evidence that the district was subjected to considerable ice action in remote ages, it is presumed by geologists that the osmiridium was carried away and deposited in this sedimentary rock by melting glaciers. That is perhaps the only way to account for its presence there. Although traces of osmiridium have occasionally been found in serpentine rock in Tasmania, it has never been found there in payable quantities. I am therefore led to conclude that the osmiridium found today must represent an accumulation from vast quantities of decomposed serpentine now non-existent. The serpentine from which the metal was derived is an altered olivine rock, possessing abundant traces of pyroxenite, magnetite, peridotite, and chromium. Other kinds of serpentine rock are also found in Tasmania, but no trace of osmiridium has been found near these, and for the most part they consist of barren gabbros.

The fields in Tasmania, all being of a shallow and easily worked nature, are mined by individual "diggers" and not by corporations. Under the State Mining Act, fifty yards square is the area permissible for one man to hold.

Existing methods of recovering osmiridium are of the most crude and primitive character—a pick, shovel, ax, and tin prospecting dish being the miner's tools. The mode of mining this valuable white metal is similar to that employed on all other shallow alluvial fields, sluicing, cradling, "puddling," and dishing being some of the methods in vogue. Whichever system is used, however, is entirely dependent on the nature of the ground worked and on the quantity of water available for washing purposes. Some remunerative returns were obtained from claims in the early days of the Adams River field, one patch of ground yielding its owners over 11 oz. of osmiridium within two hours or so, on one occasion. At the prevailing price of £32 15s. per ounce, such an output was extremely profitable. Numbers of men were making between £40 and

Part of main camp at Adams River osmiridium diggings, Tasmania

Prospector washing a dish of "pay dirt" at Adams River diggings



Puddling clayey "pay dirt" before washing at Adams River diggings

Sluicing operations on Adams River osmiridium deposits

£200 per week, but such halcyon days could not last forever, and all these rich claims are now things of the past.

The Adams River field has already seen its best days, and the total output has dropped to a few ounces a week. This can easily be understood when it is realized that in the boom days of the field more than 2,000 men were at work there. The total area of the whole field is very small, and with such a number of miners at work it could not be long before it was exhausted. Only a very few miners are there now, and with the exception of one or two claims, the others are not returning their possessors more than about 12 gr. to 1 dwt. of metal per diem. At the present market prices these are not payable, for owing to the inaccessibility of the field and the expense of having stores sent there on pack horses, the cost of living is very high, being fully 75 to 100 per cent above that ruling in more civilized regions. Most of the men now remaining on the field are just hanging on in the hope that the market will show an upward trend in the early part of 1927.

The only other field now being worked in Tasmania is situated on the Savage River, on the Northwest coast. This was the main source of production in the island for many years, and although more difficult to work than the Adams field, operations being possible only when the river is extremely low, it is now almost exhausted. A few "fossickers" are still working there, but this appears to be more from a sense of sentiment than from financial reasons, for the value of the entire annual output in 1925 amounted to only a few hundred pounds sterling.

There are no other known osmiridium fields in Tasmania, and unless one is soon discovered the island will lose its proud position of being the world's largest producer of high-grade osmiridium.

Rotating Electric Furnace Developed for Burning Limestone and Roasting Ores

An electric furnace known as the "Calimite" has been developed for burning limestone and gypsum and for roasting arsenical pyrites and other ores, where the heat required varies from any temperature up to 1,100 deg. C., according to the *Chemical Engineering and Mining Review*, of Melbourne, Australia.

The furnace is of the rotary type and comprises an inner tube member of steel, and upon this is wound a "Brightray" heat unit. The tube and winding are then surrounded by a non-conductive covering to prevent radiation, and the whole provides the actual heating portion of the furnace through which the material passes during the roasting process. This actual heating portion is carried in a cradle, and is capable of rotation by passing the tube through runners which move over rollers on a fixed frame, the runners being held in definite spaced relationship by means of stay rods.

At each end of the furnace are slip-rings of copper or copper alloy which are insulated from all surrounding material, and connecting the slip-rings at diametrically opposite positions are conductor bars adapted to receive the ends of the resistance winding previously described. In contact with the slip-rings are carbon brushes receiving electrical energy from a source of supply, the current passing from the brushes to the slip-rings, then to the conductor bars, and finally to the resistance winding to heat the tube.

The furnace is rotated by a worm drive and thermostats are arranged to control the furnace temperature.

Ore or limestone is fed from the bins by screw conveyors to the furnace. The roasted product passes through coolers at the other end of the furnace and is discharged by gravity. The feed end of the furnace can be raised or lowered by means of a screw, which thus regulates the time of roasting by determining the speed at which the material passes through the furnace.

Where current is not obtainable in bulk supply at a reasonable cost, it is proposed to use oil engines and generators to provide the current, the cost of which will depend upon the amount developed. With a 10-ft. furnace, treating two tons of limestone for one ton of lime every hour, it is estimated that the cost of heating would be 12s. 6d. per ton of lime produced.

The special advantages of the furnace are: (1) The heat control is perfect; (2) the products of combustion do not come in contact with the material during the roasting; (3) fines can be efficiently treated; (4) the carbon dioxide produced from limestone is pure and can be saved; (5) no space is required for stacking or storing fuel; (6) 95 per cent of the heat is utilized, as against 30 per cent in ordinary lime-burning operations; (7) it can be applied to the distillation of oil-shales.

The furnace, which has been patented throughout the world, is the invention of E. Halloway, of 434 Collins St., Melbourne, who is now constructing a furnace 10 ft. long by 2 ft. internal diameter for the treatment of limestone.

Accidents at Metal Mines in 1925

A total of 126,713 men were employed at metal mines and non-metallic mines in the United States (except coal mines and stone quarries) in 1925, according to reports received by the U. S. Bureau of Mines from operating companies throughout the country. This represents an increase of 3,585 over the number employed in the preceding year. These men worked 37,172,359 man-shifts, an average of 293 workdays per man, as compared with 35,734,008 man-shifts and 290 workadys per man in 1924. Each of the larger branches of the industry except iron mines showed an increase in the number of employees. Iron mines employed about 2,000 fewer men than in 1924, but the reduction was about counterbalanced by an increase in the average working time per man from 269 days in 1924 to 275 days in 1925.

Of the total number of accidents at all mines, 371 were fatal, 21 caused permanent total disability, 653 caused permanent partial disability, 8,163 caused injury of a temporary nature disabling the employees for more than fourteen days, and 26,295 caused temporary disability exceeding the remainder of the day of the accident but not exceeding fourteen days.

The principal causes of accidents that resulted in death were falls of rock from roof or wall, explosives, haulage, and persons falling down chutes, winzes, raises, or stopes. Of the total number of deaths, 273 were from accidents underground, 39 in shafts, 25 in open-pit mines and 34 in surface shops and yards.

Discussion

"Engineering and Mining Journal" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief. Letters will not be printed unless the author's name and address are known to the editor.

Pearls in Oysters

THE EDITOR:

Sir—Mr. Emmens' letter in your March 26 number calls for a reply.

To begin with, there are two premises so obvious that I believe everyone informed on mining matters will accept them without argument.

First, mining *is* a business, not a "game" to bet on, nor a pursuit of technical and scientific interest only. Mining enterprises are begun and carried on in the sole hope and expectation of making them pay a reasonable return on the investment.

Second. Being a highly speculative business, in the early stages, at least, it is vital, to a well-conducted exploration and development campaign, to select for testing a few of the many offerings. This process of selection depends on many things, including several that have very little to do with any particular property considered.

There is no end of geological theories and possibilities of ore deposits to be tested over the world, but there are limitations to every exploration and development campaign, no matter how ambitious the scale on which it is undertaken.

To say that British Columbia "really has the mineral resources," or to declare that the Pre-Cambrian shield of Ontario and Quebec contains many Hollingers and Norandas is merely to include a great deal of territory in a generalization.

It is a somewhat different matter to actually find "real honest-to-goodness worth-while prospects that are ready and waiting for the men who can furnish the money and brains to put them to producing."

There has been no lack of money in British Columbia for the last few seasons, at least, nor of mining experience and ability back of it. The reason it came into the province and persists here is because there is faith in the mineral resources of the province.

It has not been my experience that the examining engineers Mr. Emmens refers to are at all backward about recommending or refusing properties.

It should not be necessary to say that a prospect or partly developed property offered for consideration seldom shows conclusive evidence to indicate its prospective value, and when such evidence does exist it generally definitely points to the limitations of the property. Any examining engineer of experience and judgment is slow to condemn outright a prospect whose exposures are too limited to form any definite conclusions on; also, he has seen too many attractive showings to assume that each one must lead to a valuable deposit. Therefore, if he really has the experience and "mining sense" Mr. Emmens proclaims, his decision "very definitely for or against" will often be tempered by a realization that the property has possibilities, though it may be of no interest at the moment.

Mr. Emmens' statement that the present "scouting engineers" in British Columbia "are loath to recommend a property that has not ore actually blocked out on four sides" is incorrect, and there are plenty of instances to the contrary. His further statement that the Englishman and Canadian "hesitate long before taking hold of a property in which ore is not actually blocked on four sides" is also incorrect, whether he means the individual engineer or the organization back of him.

It is the English and Canadian organizations, staffed with English, Canadian, and American engineers, that have recently been, and still are, most active in the search for mines in British Columbia, and if the Americans "have the field largely to themselves" they have managed most skillfully to conceal it from everyone but Mr. Emmens.

In regard to the plum crop they are gathering, I surmise some of them eventually prove to be not what they seemed. The Premier, it seems to me, deserves a rest for a while, as it has done more than its share in advertising the mineral wealth of the province. Besides, it is a plum that was picked some time ago.

The best description that I ever heard of this business of searching for mines was by R. A. F. Penrose, who said it is like looking for pearls in oysters; each oyster we open may hold a pearl, but we have to open a great many oysters before we ever find a valuable pearl.

To carry on the simile, there are a great many oysters in British Columbia, and some of them will be found to contain pearls; the scout engineers now in British Columbia are examining many oysters, and their principals are spending large sums in the province to open some of them in the hope and expectation of finding an occasional pearl.

E. P. CRAWFORD.

Kimberley, B. C.

Support for the Divining Rod

THE EDITOR:

Sir—Why evade the divining-rod subject at home and go to Europe and dig up all the misleading affairs that you can possibly hear of? The operator of the rod that your paper mentions in the issue of April 2 is all wrong in his idea of attraction. There is only one true law of attraction and that is positive if properly applied in connection with the rod, and according to your story the man in Cornish *(sic)* has not got it.

Why wouldn't it be a good idea for *you* to learn a few real facts about this instrument and tell *them* something. I am inclined to believe that you have scandalized the rod so vehemently and so long that you dare not learn the truth about it and excuse yourself. How about that test for mineral location? Dare you publish this?

J. H. ROBINSON.

West Somerville, Mass.

Useful Operating Ideas

Use of Explosives in Drift Rounds

Twenty Rules to Be Observed in Promoting Approved Safety Methods

In U. S. Bureau of Mines Serial No. 2789, E. D. Gardner discusses methods of charging and firing drift rounds in metal mines. Several excerpts from his paper are given in the following:

Seven-foot fuse are generally issued for blasting ordinary drift rounds. To get the proper sequence of firing, a section 12 to 18 in. long is ordinarily cut from the fuse in the first hole to be shot and a section ½ to 1 in. less than that for the first hole is cut from each succeeding fuse, except that the last lifter is not cut. Fuse used in the West burns at about forty seconds to the foot at sea level, and the manufacturers hold the variations to 10 per cent either way at time of manufacture. In an 18-hole round there would be an interval of 3⅓ seconds between the burning time of each fuse and that of the succeeding hole if each fuse were to be exactly one inch shorter than the preceding one and all the fuse were to burn at the standard rate.

Holes are spit in the same rotation as the firing sequence, and where no difficulty is experienced the time required to spit a drift round with an open-flame lamp is three-fourths of a minute to one and one-quarter minutes. This added period about doubles the time differential for successive holes.

Should the burning rates of two kinds or lengths of fuse differ to the full amount of the allowable tolerance, one above and the other below the limit of tolerance, a difference of 44 seconds could be obtained between two 5½-ft. lengths. With good fuse adapted for the purpose, however, there is reasonable assurance that the holes will be fired in the required order where a difference of one inch exists between successive holes. With a poor fuse or one not best suited for the work, some of the holes may fire out of turn and spoil the round. In any event, it is desirable to give as much difference between successive charges as practicable without trespassing on the time required for safety.

In most drift rounds no advantage is obtained by having certain holes fire before others. Thus, after the cut holes fire, it is immaterial whether the breast holes or skimmers fire next. Also, in most rounds, either one of a pair of side holes could detonate before the other without influencing the break of the round. Such holes are grouped and shot with the same delays in firing electrically, and it is recommended that the same plan be followed with fuse by cutting all the fuse of one group the same length.

In an 18-hole round which was drilled according to the Copper Queen "standard" round, the holes could be grouped in this manner: (1) 2 center cuts; (2) 4 side V-cuts; (3) center breast and center skimmer; (4) 2 side breasts and 2 side skimmers; (5) 2 side top breasts; (6) back hole and center lifter; (7) 2 side lifters. This arrangement permits a difference of three inches instead of one inch between the fuse for the last hole of one group and the fuse for the first of the next, and adds to the assurance that key holes will detonate in the proper order. The disadvantages are that this method of trimming the fuse makes it more difficult to spit a round, as it is necessary to go from top to bottom of the face and back again. Also, the holes do not detonate in the same even manner as when the usual method of trimming is used, and this makes it harder to count the shots.

Pressure on fuse affects the burning rate; therefore, all the holes in a drift should be tamped alike and the primer be placed in the same relative position in each hole.

Nearly always trouble is experienced with missed holes when a mining company first begins to use electric methods of blasting. This is due mostly to unskillful loading and wiring. In the larger mines electric current from lighting or other circuits is generally available for firing electric detonators, but occasionally a blasting machine will be required.

When there is ample current the detonators of a round should be connected in multiple, but where it is necessary to use a portable blasting machine it is best to connect the holes in series. Wiring in multiple is preferable when the current is available. The highest voltage current available up to 440 volts a.c. or 500 volts d.c. should be used, as there is less likelihood of misfires from leakage of current or short-circuiting when working with a high voltage. When wiring in multiple the legs of the individual detonators should be long enough to reach to the bus wires without splicing. The leg wires for a 6-ft. round in a 6 by 7-ft. face should be 10 ft. long. Each detonator should be tested with a galvanometer before and after loading, to insure that no circuits are broken. The ends of the two leg wires of each detonator should be twisted together before detonators are taken underground, in order to prevent possible premature explosion by stray electric currents. When the two wires are twisted thus they act essentially as one, which prevents establishing a circuit through the detonator.

After the round is loaded, the bus wires, which should consist of uninsulated copper wire of about 16 B. and S. gage, are strung across the face and fastened to two wooden plugs or stakes. Care should be taken that the bus wires do not touch each other. One wire of each detonator is attached to one bus wire and the other wire to the opposite bus wire. Each wire should be attached individually and care taken to make good connections and that no short circuits occur. After the work is finished, all connections should be checked to insure that no wires were overlooked or that both wires of a detonator are not connected to the same bus wire. When a round is wired in series, the circuit should be traced from one lead wire to the other through all the holes.

The temporary firing line, which should consist of No. 14 lead wire, No. 18 annunciator wire, or No. 20

connecting wire, should then be connected to the bus wires and the work proceed away from the face. The ends of the permanent blasting line should be touched together, to make sure they carry no current, before the connections to the temporary firing line are made. The round should be fired through a safety switch, which must be kept locked in an open position and to which the miner in charge of the blasting has the only key. Firing in series requires extra care in wiring, as leakage of current is more likely to cause misfires. When a blasting machine is used, all connections on the firing line should be carefully made and taped.

In blasting electrically from a lighting or other circuit, the switch should be pushed in and immediately withdrawn. Leaving the switch closed may cause an arc between two wires and set the insulation of the wires on fire. Recently in reblasting three missed holes in a raise with the same detonators the miners left the switch closed for about one-half minute. The insulation on the wires of the detonator caught fire and burned up into the charges. The detonators again failed, but the burning insulation ignited the explosive in all three holes, and then detonated about twenty minutes later as men were standing under the raises.

Electric blasting has a twofold advantage over fuse and detonators in wet drifts: there is less likelihood of misfires occurring as a result of the presence of moisture, and the danger of men staying too long at a face while spitting wet fuse is eliminated. Hangfires are less frequent with electric blasting and men can take plenty of time to reach a place of safety before firing a round. The possibility of misfires from fuse being cut by previous shots is eliminated, and the rotation of firing is surer with electric blasting.

All faces should be carefully inspected for misfires before any work is done at the place. In case of a misfire in a drift round, no one should be allowed to return to the face for one hour, if fuse is used, or one-half hour if the round was blasted electrically. Missed charges should never be withdrawn from a hole, but should always be reblasted by inserting a fresh primer in the top of the explosive. No picking or drilling should be done in a face in which a misfire occurs until the missed charge is blasted.

A summary of points to be observed is as follows:

1. It is not economy to use cheap fuse, detonators, or electric delay detonators, as a very few misfires will cause a greater loss than any saving made in the purchasing price of the blasting supplies.

2. All fuse for use in the mine should be "capped" at a central point by a well-qualified man, who should be provided with proper tools for the purpose. Indifferent or careless work in the detonator house can cause much trouble and danger from missed holes. Capped fuse should be taken underground in closed, rigid containers and kept in lockers separate from the explosive. Capped fuse should be issued separately from the explosive and carried in separate bags to the working places. Fuse used in wet work should be waterproofed at the junction with the detonators.

3. The best method for making the primers should be studied for the condition existing at each mine and a standard method adapted for all faces.

4. Primers should be made in such a manner that the detonators cannot be pulled from the primer cartridges, either in loading or by the action of the detonation of preceding charges.

5. Primers should be made in such a manner that the fuse will not be kinked or bent sufficiently to cut the train of fire in the powder core after the hole is loaded. In blasting electrically the wires of the delay detonator should not be kinked or the insulation damaged.

6. The primer should be placed deeply enough in the holes to assure that when fuse is used the train of fire in the fuse is within the solid rock before the first hole of the round detonates. Also, the primer should be deep enough to make certain that the severe action on the fuse from preceding shots will not displace the primer.

7. Where there is danger of overbreak from any hole, the primers of the other holes should be deep enough to make it impossible that they will be cut off and become mixed with the blasted material.

8. Charges should be well tamped, as greater loading density increases the efficiency of an explosive.

9. The use of care and forethought in loading will prevent cartridges becoming jammed in drill holes.

10. Stemming increases the efficiency of the explosive and reduces the amount of poisonous gases produced in the gases from blasting.

11. Drill holes of drift rounds should not be loaded to the collar, as the energy of the explosive in the outer part of the hole cannot be expended to the best advantage. If the rock cannot be broken by normal loading, the number of holes to the round should be increased or a higher grade of explosive used.

12. Electric delay detonators should be used for blasting in wet ground.

13. To insure the proper rotation of firing with fuse and detonators, the difference in length of fuse between the successive holes should be as great as practicable.

14. The shortest fuse in the round should always be long enough to give the men ample time to reach a place of safety.

15. Rounds fired electrically with a blasting machine should be wired in series and rounds fired from an electric circuit should be wired in multiple.

16. Great care should be taken in wiring rounds for firing electrically, as only in this way can misfires be prevented.

17. Blasting accidents are less likely to occur with electric blasting than when blasting is done with fuse and detonator. Also, fewer misfires occur in wet work with electric blasting.

18. Faces in which misfires occur should not be approached within one hour after the round was fired with fuse and detonators, or one-half hour if fired electrically.

19. Missed charges should be reblasted by reinserting a fresh primer above the explosive before any work is done in a face in which misfires occur.

20. Drill holes can be charged safely, and premature explosions are nearly always the result of careless or hurried work. Ample time should always be allowed for charging a round, so as to assure that the work can be done properly. The energy of the explosive is expended most efficiently, and accidents from misfires are prevented, when those charging the holes use care and common sense in doing the work.

News of the Week

Summary

AMPLE AUTHORITY is provided by existing laws for the carrying out of plans to render increased federal service in the interest of those who produce or consume mineral commodities. Additional appropriations are necessary.

The North Carolina Department of Conservation and Development reports a general revival of interest in gold mining in the state. The state geologist, however, although several of the properties appear to be promising, recommends caution before operations are begun.

A verdict for $10,000 was returned by a jury in the district court of Itasca County, Minn., against the Mesaba Cliffs Iron Co., and in favor of an employee, who, it is said, contracted tuberculosis while in the employ of the company.

Loading of iron ore on the Marquette Range began on April 11. Navigation is again open at the Soo.

The retiring president of the Associated Scientific and Technical Societies at Johannesburg, South Africa, urges members to enter the House of Assembly.

All labor disputes in Mexico are to be handled by the federal government. New lead properties are being developed in northern Chihuahua. It is expected that the Durango-Coahuila boundary line dispute will soon be settled.

The situation in China causes interest in mining shares to wane on the London market. The Union Corporation annual report, recently issued, shows a record year for the corporation; East Geduld Mines, on the Witwatersrand, and the San Francisco Mines of Mexico are chiefly responsible for the favorable situation.

A recent auction sale of 190 town lots on the Horne Copper property, at Rouyn, Quebec, brings $260,000.

Speed appears to be the essence of contracts for the erection of buildings at Weepah, Nev. One of the gambling halls was put into operation the evening of the day on which construction was started.

The Great Copper District in Northern Rhodesia

Development Under Way at N'Changa, N'Kana, Roan, Mimbula, and Chingola—Ore in Feldspathic Quartzite Beds

By George L. Walker
London, England

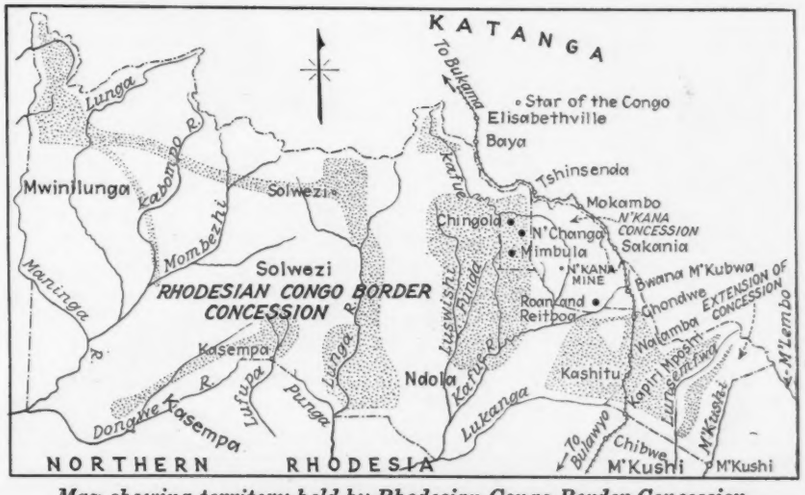
THE ACTIVITIES of the Rhodesian Congo Border Concession, N'Changa Copper Mines, Bwana M'Kubwa, and A. Chester Beatty's Selection Trust, Ltd., are opening up in Northern Rhodesia what promises to become a copper mining district of first magnitude. Developments to date point strongly to the possibility that ore tonnages containing more copper than exists in the ore reserves of Chile Copper and Utah Copper combined will be proved during the next few years.

Geologically the district is an area of stratified rocks which have been folded quite regularly by granite intrusions. The ore occurs in the feldspathic quartzite beds of these sedimentaries, as wide, rich, and persistent lodes.

Five separate deposits already are being developed — namely, N'Changa, N'Kana, Roan (or Reitbok), Mimbula, and Chingola, every one of which gives evidence of containing a very large tonnage of copper ore of excellent grade. These properties cover only a portion of the area that geological conditions indicate to be ore-bearing. The remainder of the area, in which the rock formations are mostly covered by soil, is controlled by Rhodesian Congo Border, N'Changa, Bwana M'Kubwa and Selection Trust, Ltd. After further geological investigation in this area, favorable ores will be drilled. In the meantime the several deposits mentioned are being actively developed by underground workings, and also drilled to determine the extent and grade of the ore.

The N'Changa deposit occupies a geological basin. On the Main Lode side of this basin, work has been under way for a year on the 150 level, where the first 725 ft. opened along the strike was proved by several crosscuts to average 4.72 per cent copper over an average width of 72 ft. The 150 level has now followed the strike in ore for approximately 1,000 ft.

On the opposite side of the N'Changa basin, called the Dambo Lode, the ore has been found in five vertical shot-drill holes, about 600 ft. deep and put down at intervals of 800 ft. in a direct line along the strike. Numerous other drill holes also prove the richness and continuity of the ore. Two incline shafts are being sunk on the Dambo side, and the Main Lode workings soon will be deepened. The distance across the basin from the Main Lode to the Dambo shafts is approximately 4,000 ft., and it is indicated that the ore



Map showing territory held by Rhodesian Congo Border Concession. The stippled area has been partly prospected

reaches a depth midway of 1,500 ft. or less.

The N'Kana deposit, in the N'Kana Concession, which is owned by Bwana M'Kubwa, has an indicated length of three or four miles, and it may prove much longer. To the end of last November it had been proved for a length of 7,740 ft. by shafts sunk at intervals of 800 ft. to a depth of 100 ft. Drifting and crosscutting over a length of 3,390 ft. of this had proved 810,000 tons of 5.1 per cent ore, all above the 100 level, the average width being 35.8 ft. Including this, a total of 1,409,000 tons averaging 4.6 per cent had been developed.

Reserving an area of 70 square miles covering the dip and five miles in each direction on the strike of the N'Kana deposit, Bwana M'Kubwa has entered into an arrangement by which the Selection Trust, Ltd. (A. Chester Beatty) is to prospect the remainder of the 1,800 square miles of the N'Kana Concession. Selection Trust has paid £25,000 for this privilege, Bwana M'Kubwa retaining an interest in whatever is found. This area is favorably situated in its relation to the N'Kana, Bwana M'Kubwa, and Roan and Reitbok mines, and to the southern mines of Union Minière du Haut-Katanga.

The Roan and Reitbok, controlled by Selection Trust interests, is another deposit of ore of the basin type. Development by shafts is going ahead rapidly. A drill has cut the ore at the bottom of the syncline, a depth of about 500 ft. Some millions of tons of ore already have been proved and the ultimate development of 50,000,000 tons or more seems probable. The lode is 40 ft. wide and averages about 4 per cent copper.

At the Mimbula, which is 10 miles south of N'Changa, an area of 5 square miles is practically continuous oxidized ore averaging 1½ to 2 per cent copper. It may prove to be the largest deposit of such grade of copper ore in the known world. Evidently this ore is the result of the surface weathering of important lodes similar to those at N'Changa and N'Kana. A drill put down recently in this area entered a lode at a depth of 350 ft., continuing in it to 425 ft. It then passed through a low-grade formation to 570 ft., where rich ore again was encountered, continuing to 595 ft. The first of these deposits is computed to have a true width of 57½ ft. averaging 3.3 per cent, of which 30.6 ft. averages 3.9 per cent copper. The lower deposit apparently has a true width of 19 ft. and averages 5.3 per cent copper. Drilling is being continued.

The Chingola, like the Mimbula, is a Rhodesian Congo Border Concession property. It is near the N'Changa, and in view of its geological outline is not unlikely to exceed it in ore tonnage. Samples from the Chingola outcrops are practically identical with those from N'Changa Dambo. It is understood that Chingola will be investigated at depth immediately. Of the Mimbula and Chingola the chairman, F. L. Gibbs, said recently: "Developments have not yet advanced sufficiently for me to make any definite statements regarding these two properties, except that we are certain that they are similar to the N'Changa property."

All of the copper deposits mentioned in the foregoing are relatively near together in an area 15 to 75 miles west of the Rhodesia-Katanga Junction Railway. From the Bwana M'Kubwa mine to the Chingola property is about 85 miles, and the several other developments are, roughly, between. They are immediately south of the eastern end of the Katanga copper belt. Railway construction seems likely to be a joint arrangement.

The deeper ores in all of these deposits are made up of cleanly disseminated chalcocite, with little or no pyrite. This sulphide ore is of the character ideal for concentration by flotation. Near the surface the ore is chiefly malachite, with some silicates and oxides. Evidently, when oxidizing, the copper remained almost wholly in place, as relatively little secondary enrichment is indicated.

The region in which these ore deposits occur is described as one of the most pleasant and healthful in Northern Rhodesia.

Rapid construction at Weepah, Nev. Photograph of gambling hall was taken at 3.30 p.m., March 31. The building was open for business that night

Jackson Munion vein near Woman Lake, northwest of the Red Lake district. The vein is now being developed

Loading of Ore on Marquette Range Begins—Soo Open

The loading of iron ore on the Marquette range was begun on April 11, when a steam shovel was placed in operation in the open pit at the Rolling Mill mine, Negaunee, Mich. The mine has also started loading underground ore at the pockets. Some of the other properties have since filed requests for railway cars.

Navigation is open at the Soo; the first boat reached the docks at Marquette this week. Many sales were reported following the recent determining of the ore price schedule for 1927.

Consolidation of Properties in Mohave County, Ariz.

It is reported that E. S. Clark, of Phoenix, Ariz., and A. B. Peach, of Prescott, have recently closed negotiations whereby Eastern interests will take over and consolidate the Oro-Golconda, Oro Plata, Middle Golconda, and Golconda mining companies, owners of a large mineralized area in Mohave County lying approximately midway between the towns of Kingman and Chloride. The purchase price is said to have been about $1,000,000. It is understood that the new owners plan to expend another million in development work and surface improvements. One of the possibilities of this consolidation is the development of all veins from a common level. The mines are about 16 miles north of Kingman and about 4 miles from the Santa Fe-Chloride railroad.

Contracts Awarded for Drilling More Potash Test Wells

Contracts for the drilling of two additional potash test wells in southeastern New Mexico have been awarded by the U. S. Bureau of Mines, Department of Commerce, to the Sullivan Machinery Co., of Chicago, which submitted the lowest bids for the work. Under the terms of the contract, drilling operations are to start within a period of thirty days. Both new locations, which are recommended by the U. S. Geological Survey as giving favorable indications of the existence of potash beds, lie in Eddy County.

The site of potash well No. 2 is in the northeast corner of Sec. 14, T. 20 S., R. 29 E., approximately 37 miles from Artesia, N. M., and 25 miles from Carlsbad, N. M. The depth to the top of the salt bed at this location is estimated at about 500 ft. Drilling will be continued to a depth of 1,000 or 1,500 ft., as conditions may determine, thus allowing penetration of most of the estimated thickness of the salt beds in this region. The site of potash well No. 3 is in the SW.¼ of Sec. 34, T. 22 S., R. 30 E., and is about 28 miles from Carlsbad. The depth for drilling is the same as for well No. 2.

Both locations are on the western limit of the potash-bearing salt beds identified in this region, and have a minimum of overburden. For each test a continuous core will be taken from top to bottom and each hole must bottom with not less than a 2½-in. core.

The diamond-drilling outfit used in the drilling of potash well No. 1, also located in Eddy County, will be moved immediately to the site of well No. 2. Drilling of potash well No. 1 was completed April 9, at a depth of 1,847 ft. 6 in., operations having been in progress since Feb. 21. At this location, the hole penetrated the salt beds at a depth of about 850 ft. Various favorable showings of potash-bearing salts were encountered in this well. To a depth of 150 ft., coring of the soft "red beds" overlying the salt formation, with equipment consisting of a standard bit and single-tube core-barrel, was attempted unsuccessfully. From 150 ft. to the bottom of the hole, a specially designed bit and double-tube core barrel were used, and 1,600 ft. of core, amounting to 94 per cent, was recovered. The 6 per cent loss was due to attrition and to occasional thin seams of sand or soft clay interbedded in the harder formation.

The cores taken from potash well No. 1 have been turned over to the Geological Survey for study and analysis; their composition announced later.

Arizona's Sodium Sulphate Plant Produces 120 Tons Per Day

The plant of the Sodium Products Corporation, Prescott, Ariz., which produces sodium sulphate, so largely used in the glass and paper industry, is shown in the accompanying photograph. This natural sulphate deposit is in the Camp Verde Valley of Arizona, and is for the most part near the surface of the ground, making it readily workable without the necessity of installing expensive equipment. The deposit was opened up a few years ago by the Western Chemicals, Inc. Quarry equipment was relatively crude and was entirely insufficient for large production. After working the quarry for some time the company found itself involved in financial difficulties. A new company, headed by R. W. Coad, of the Sodium Products Corporation, was formed, with a capital of $400,000. The new company immediately undertook the work of remodeling quarry equipment, management, and merchandising plans. The entire plant was rebuilt. As it stands today, instead of a daily production of from 30 to 50 tons, with three shifts of men, now one shift produces, regularly, approximately 120 tons per day.

The deposit is in a mountain side and the portion exposed shows a face of from 50 to 70 ft. in height and several hundred of feet in length. The ore lies under an overburden of earth and clay, varying from two to ten feet in depth, and this is easily removable by a gasoline shovel, after which the ore is drilled and dynamited. The fragments then are loaded into trucks and hauled to the storage bin. From this bin the ore is fed into a 30 x 30-in. Jeffrey roll crusher and then carried on a conveyor belt to the storage bin. From here the ore goes to a series of eight log washers, each 20 ft. in length, wherein it is washed six times, removing the clay and other impurities. The ore then passes over two dewatering screens and goes into a rotary drier, 50 ft. in length, where it is subjected to a temperature of approximately 700 deg. F. After leaving this drier the ore is fed into a secondary crusher, from which it emerges with no fragment exceeding ¾ in. in size. Then it is elevated into the mill by a bucket conveyor and passed over screens of differing mesh which grade the ore. The first grade, consisting of the ¾ in. fragments, is designed for the pulp and paper industry; the second grade, of minus-10 mesh, goes to the glass industry, and the third grade, of minus-20 mesh, is utilized by the manufacturers of stock remedies.

Plant of Sodium Products Corporation, Camp Verde Valley, Arizona

Pioneer and Argonaut Active

At the Argonaut Consolidated, shaft sinking will reach the 1,250 level within a few days. New levels will be opened up at that depth, and also at 1,125 ft. Four good veins have been opened up on the 1,000 level, and, if this ore is found at greater depth, it should be possible to increase the mill tonnage from 100 to 150 tons a day. The Argonaut also has a large share interest in the Laval-Quebec, which owns claims in the Rouyn district, and has been able to sell 300,000 shares at 35c. and 100,000 shares at 40c. Part of the money raised from the sale of shares was used to redeem Argonaut bonds having a par value of $166,000.

The Pioneer Mining Corporation is obtaining encouraging results at its Clearwater Lake properties northeast of Red Lake. The original showing was approximately 24 ft. square, with an indicated average of about $10. This has now been opened up for a length of 200 ft. Four trenches have indicated a width of 37 ft., giving values of $5 to $7. Though this is comparatively low grade, considering the distance from rail transportation, it is an exceedingly interesting surface showing, and warrants much more work.

Credit Where Due

The news item on page 616 of the issue of April 9, which related the fact that the Iron Mountain mine in Missouri had passed under the control of the M. A. Hanna interests, was evidently taken from *Skillings Mining Review* by the correspondent who sent it in, as that publication has pointed out. Ommission of credit is regretted.

Many New Operations in Colorado

The discovery of gold near Summitville, Colo., has caused considerable excitement in Denver. John W. Pickens, of Summitville, made the original discovery some twenty years ago, but as he could not obtain a lease on the property, he kept the discovery a secret. Mr. Pickens and Judge J. C. Wiley, of Del Norte, Colo., have formed a company known as the Summitville Gold Mining Corporation, and have located forty-five claims near the original find. Two crosscuts, made years ago when Summitville was producing, missed the rich pocket, but are favorably located for drifting to the rich ore. It is stated that twenty-two tons of ore, which bought $102,000, have already been shipped from the property.

The International Smelting Co. announces the discovery of a new orebody, measuring 12 ft. in width, in the Shamrock mine, at Rico.

The Wolf Tongue Tungsten Co., of Boulder, a subsidiary of the Firth-Sterling Steel Corporation, of England, is increasing its production. By the new terms which it has granted to lessees in the Nederland district better prices are specified for low-grade ores, and a decrease in royalty fees the first year of prospecting. The company also reports the discovery of a new tungsten orebody on the Cold Spring claim near Bouder.

The Wellington Mines Co., of Breckenridge, is installing a selective flotation plant in its No. 1 mill. Harry Matchen and A. J. Weinig, of the Colorado School of Mines, will oversee the installation.

Operations at the central property, on Sheep Mountain, of the Empire Chief Mining Co. are expected to begin soon. A new mill is being considered.

It is reported that the new plant of the Colorado Incorporated Mines Co. will be put in operation this week. The plant includes a 100-ton mill, which was erected at a cost of $200,000. The company has also made extensive repairs on the tramway lines.

A new company formed at Rico—the Rico Enterprise Mining Co.—plans to work that part of Newman Hill lying above the Group tunnel. The ground will be entered from the Revenue tunnel, which, it is claimed, will open the contact at much less expense than by going through the Group and Pro Patria tunnels.

Revival of Gold Mining in North Carolina

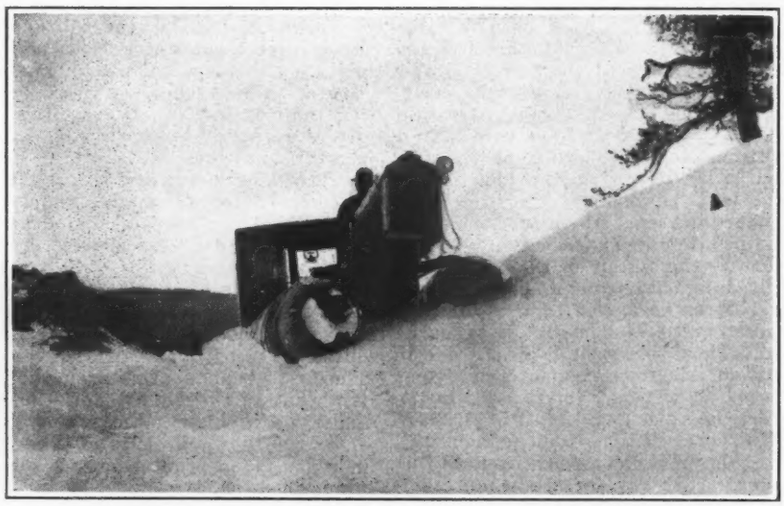
The North Carolina Department of Conservation and Development reports a general revival of interest in gold mining in the state, which gives promise of the reopening of several mines and the launching of operations on a large scale in some of them. Machinery has been installed at the old Shaffer mine, in Gaston County, about 15 miles west of Charlotte, and it is understood that plans have been made to operate the mine on a large scale.

A vein 9 ft. wide and 500 ft. long, assaying as high as $800 per ton, has been discovered in an old mine in Yadkin County, and the Humphries Mining Co., with a capital stock of $200,000, has been organized for the purpose of working the deposit. Investigations are being made in Nash and Franklin counties to determine the value of several deposits. Another prospective development is that of the old South Mountain placer deposit near Pilot Mountain, in Burke County, where some interesting specimens have recently been found.

State Geologist H. J. Bryson has investigated some of the deposits, and has expressed the belief that several of the properties should yield a paying amount of metal under proper operation. He has recommended, however, that thorough surveys be made of the properties before operations are undertaken.

Snow-Motor Opens Up Region

The snow-motor, shown in the accompanying photograph, is used to open up the 16-mile McKenzie Pass in the Oregon Sierras between Eugene and Bend. This pass formerly was closed from November to June on account of deep snow. The snow-motor is now the first machine to make the passage in winter. It has opened up a region hitherto inaccessible throughout the cold months of the year and eliminated a detour of 100 miles in crossing the mountain. The snow-motor is powered with a common tractor motor, and draws a special cab.



Snow-motor going through McKenzie Pass in the Oregon Sierras

Johannesburg Letter

By John Watson

Special Correspondent

183,971 Kaffirs Working on the Rand in February—Five Shares Make Good Advance

Johannesburg, March 15—The monthly output of Transvaal gold for February was declared by the Chamber of Mines on March 10 as 779,339 fine ounces, having a value of £3,310,422. These figures show a decrease, compared with those for January, of 60,443 fine ounces, equal in value to £256,745. February had only twenty-four working days, whereas January had twenty-six. Compared with February of the previous year, this February shows an increase of 25,415 fine ounces, equal in value to £107,956. The native labor returns show 183,971 "boys" working on the Rand gold mines on Feb. 28, which is an increase of 4,187 when compared with the figures on Jan. 31.

Onverwacht Platinum, Ltd., milled 2,273 tons in February, yielding 897 oz. of refined platinum-group metals, equal to 7.9 dwt. per ton milled. Sinking from 400 level will be commenced about March 21. Lyndenburg Platinum Areas, Ltd., report that in February, on Maandagshoek section, 1,463 tons was milled, yielding 294 oz. of platinum-group metals. The decreased recovery is due to milling surface ore from Mooihoek, owing partly to water difficulties following the rains, and partly to the necessity of proving the surface area of the pipe for mining purposes.

Inquiries at the East Rand Proprietary Mines, Ltd., offices on March 9 revealed that the bodies of twenty-seven natives had been recovered since the accident recently reported at Driefontein; three bodies are still missing. The nine injured natives are recovering.

At the annual general meeting of the Associated Scientific and Technical Societies held in Johannesburg on March 10, the retiring president, H. W. Clayden, suggested that engineers should follow the example of lawyers and obtain seats in the House of Assembly, where the engineering progress of the country is being retarded by men without the knowledge required to deal with technical matters. Mr. Clayden remarked that the present pig iron requirements of South Africa would be met by one standard blast furnace working only six months of the twelve. Dr. John McCrae was elected president, and James Gray and W. G. C. Nixon, vice-presidents, for the coming year. In March, sixty years ago, the first diamond was found in South Africa. The Minister of Mines and Industries telegraphed his good wishes to the present mayor of Kimberley, on March 11, for the future welfare of the city and of the diamond industry of South Africa. The Mayor, H. Schmidt, sent a cordial and appreciative reply.

Reports from Grasfontein, near Lichtenburg, indicate that many claims are being abandoned as worthless for diamonds. On the other hand, a number of claimholders have struck pot-holes

which are yielding numbers of diamonds. A poor white lad pegged a claim, which a digger agreed to work on a half-share basis. In one week they recovered diamonds worth £1,800. Another digger found 400 carats of diamonds in one day, including one water-white stone of thirty-five carats.

The share market was increasingly active and broadened considerably, on the Johannesburg Stock Exchange during the past week. Government Areas have risen 2s. 6d. to 179s.; Geshild Props rose from 88s. 9d. to 90s. 9d.; Van Ryn Deeps from 61s. 9d. to 64s.; T. C. Lands from 63s. to 65s. 6d.; and Potgietersrust platinums from 9s. 9d. to 10s. 9d.

Tubercular Employee Sues Mesaba Cliffs Iron Co.

A verdict for $10,000 was returned by a jury in district court, in Itasca County, Minn., in favor of Henry Kinnunen against the Mesaba Cliffs Iron Co. Damages to the extent of $50,000 were asked by the plaintiff, who maintained that he had contracted tuberculosis while in the company's employ.

It was alleged that the company failed to safeguard its drinking water in the mine washing plant, where Kinnunen was employed. The testimony established the fact that the plaintiff worked at the mine during the time that Charles Bassett, another employee, who died from tuberculosis last February, was employed there. This contact, it was alleged, caused Kinnunen to contract the disease. Much of the testimony in the action was given by physicians. Prominent legal firms were identified with the case. A motion for a new trial has been made, and, if this is denied, an appeal will be taken to the Minnesota Supreme Court.

Lake Superior Season 17 Days Ahead of 1926

Although the shipping season on Lake Superior started April 15, no iron-ore loading is expected until ten days later. Several underground mines are loading cars at the shaft, but no pit loading will start until April 18. The shipping season is 17 days ahead of that of 1926. The largest shipper on the Mesabi range last year will duplicate the performance for 1927, as the scheduled shipments for the Mesabi Mountain pit will be approximately 6,000,000 tons. Minnewas mine, also at Virginia, Minn., which has been stripping for the last two years, is expected to ship ore during the latter part of the season. The Oliver Iron Mining Co. has added two electric shovels of the 120-B type, five locomotives, and twenty-five 30-yd. dump cars to its Virginia equipment.

Bay Plant to American Metal Co.

The Balbach Smelting & Refining Co. has leased its Bay plant at Newark, N. J., for a period of five years, beginning May 1, 1927, to the American Metal Co., Ltd., of New York. The Balbach Metals Corporation will continue to act as purchasing and selling company, and will be located at 61 Broadway, New York City.

News From Washington

By PAUL WOOTON
Special Correspondent

Existing Laws Provide Authority for Increased Federal Service to Mining Industry

Ample authority is provided by existing laws to carry out the plans for increased federal service in the interest of those who produce or consume mineral commodities. The only legislation required to comply with the various requests which have been made would be that in connection with the necessary appropriations. Though money probably can be found to make a start on this work, additional funds will have to be voted, if the work is made permanent. The organic act of the Bureau of Mines covers the major points specified in the requests, which embrace numerous statistical activities; fact finding as to mineral resources and reserves; data as to milling, smelting, and refining of ores; information as to the flow of mineral commodities in trade channels; marketing studies, and facts as to qualities and grades.

Import and export statistics already are gathered in great detail by the Bureau of Foreign and Domestic Commerce. The trade commissioners of that bureau can supply current data on mineral production, trade, and concessions in foreign countries. Likewise, this bureau could be the source of information as to tariffs in foreign countries, and the laws and regulations of these countries which have a bearing on the international trade in minerals. The Bureau of Mines already gathers rather comprehensive figures on domestic minerals. To comply with the requests which have been made it would be necessary, however, to include other commodities. Some statistics are issued dealing with stocks and consumption, but that portion of the work would have to be strengthened greatly. Foreign statistics would have to come largely from published reports, which could be gathered by the trade commissioners, commercial attachés, and consuls. These would be studied, compiled, and interpreted by the Bureau of Mines specialists now assigned to the various mineral commodities.

In addition to the compiling of data on known reserves, it is planned to list localities that may become producers. In this, important co-operation will be extended by the geologists of the U. S. Geological Survey. Co-operation will also have to be arranged with American geologists and engineers who are residing or making examinations in foreign countries. The service would also involve consideration of transportation methods and costs, and location of markets and marketing practices. Requirements of consumers in the matters of grade and quality, and the tests and specifications now being used, will be studied. This part of the service will include the question of substitutes, which is of increasing importance.

Manitoba, Canada, as a Metal Producing Province

The Province of Manitoba is about to become a steady producer of gold, and later possibly an important source of base metals, particularly copper and zinc, according to the Provincial Department of Mines, which has just issued a statement on "Manitoba as a Metal-Producing Province."

Attention is drawn to current activities in two widely separated fields. In the southeastern part of the province, east of Lake Winnipeg, Central Manitoba Mines, Ltd., is developing gold-bearing quartz deposits, and has blocked out considerable reserves of ore of profitable grade, averaging $12 per ton and of a total estimated gross value of $1,100,000. A mill of 150 tons' capacity is to be built this summer. High-tension electric power is being brought in from the Winnipeg River, 50 miles away, by the Manitoba Power Co.

In northwestern Manitoba, at the Flin Flon mine, a 25-ton experimental plant is trying out a method of treatment of low-grade copper-zinc ores. Some 16,000,000 tons of ore, carrying 1.68 per cent copper, 3.49 per cent zinc, and 0.074 oz. of gold per ton, has been blocked out. The successful outcome of the experimental treatment will mean the exploitation of this vast deposit on a large scale, with the expenditure of possibly $12,000,000, and the building of 85 miles of railway. Development of other similar deposits which have been discovered in the district awaits the outcome of the Flin Flon experiments.

The statement concludes that the developments of the next few months may well mark the beginning of a new era in the history of mining in Manitoba.

University of Pittsburgh Students on Trip

The senior-year students in the mining department of the University of Pittsburgh left Pittsburgh, Pa., on April 16 on an inspection trip of three weeks to the anthracite regions of Pennsylvania, the iron-mining district and granite quarries of Chester County, Pa., and the limestone mines of Bellefonte, Pa. Robert M. Black, head of the department of mining, is directing the trip. Methods of mining, mechanical equipment, geology, and features of general engineering interest will be studied. Surveys will be made at the Bellefonte mines.

The students plan to visit mines at Scranton, April 18; Wilkes-Barre, April 19; Pottsville, April 21; Shenandoah, April 22; St. Peters, April 23; and Bellefonte, April 25.

Toronto Letter

By Our Special Correspondent for Northern Ontario

McKinley-Darragh Mine Down—Auction of 190 Rouyn Town Lots Totals $260,000

The annual report of the Coniagas Mines, of Cobalt, shows that the company still has $1,300,000 on hand. Coniagas is now a holding and exploration company, and owns 61¼ per cent of the stock of the Coniaurum Mines, of Porcupine. There was, however, a small recovery of silver amounting to 137,000 oz., part of which was recovered from party walls and part from the final clean-up of the old mill floors and sumps. This brings the total production of the property to date to 32,685,000 oz., which is a remarkable production from one forty-acre claim. In addition to this interest in the Coniaurum, the company has a large number of properties and options throughout Ontario and Quebec.

The McKinley-Darragh mine, of Cobalt, has curtailed operations to the point where the property is practically closed down. This has been expected for some time, as, for the past few years, operations, even on a reduced scale, have been barely sufficient to meet operating expenses. This property is another one of the famous old Cobalt silver producers, with a total production of over 21,000,000 oz. Although the property will be closed down, the organization will remain active, as it has developed into what might be termed an "investment trust." Realizing that the company did not have sufficient funds on hand to acquire another property, the directors invested the surplus, or a large part of it, in the stocks of northern Ontario and Quebec mines. These investments already show an enhancement of approximately 50 per cent.

The Tonopah Canadian Mines, Ltd., has decided to give up its option on the Morrison property, in Gowganda. Tonopah has been developing the Morrison for more than a year. Considerable ore has been disclosed, but practically all of it has been milling ore on which the margin of profit was small. Some adjustment in the terms of the option were requested, but as this was not granted, the option was dropped. The larger operations of the Tonopah, however, are at the Walsh mine, which the company owns. The mill is handling fifty to sixty tons a day of 30-oz. ore, which is of sufficient grade to yield a moderate profit.

As expected, the Noranda has given up its option on the Plata property, adjoining the Morrison. Considerable work has been done, and a number of veins have been found, but they contain practically no silver.

During March the Dome Mines, of Porcupine, milled 36,400 tons, yielding $324,263. This indicates a yield of $8.91 a ton, which is misleading. The mill was closed down for some time, as the result of an accident in the shaft. During this period a clean-up was made of the plates and odd corners of the mill. This clean-up yielded about $75,000.

The McIntyre is now opening up eight new levels from its new No. 11 shaft, which was recently completed below 4,000 ft. At present, the 3,875 level will be the deepest; crushers and loading pockets will be put in below this level. It will be about three months before the shaft will be completely equipped and the new hoist house in running order.

At the auction sale of town lots on the Horne Copper property of the Noranda, in Rouyn, a total of $260,000 was realized from the sale of 190 lots. It is expected that this will be the nucleus of a town of substantial size, as it will not only be the chief place of residence for employees of the Noranda, but will also be a business center. A large amount of money has already been spent for water works, sewerage, and other town improvements.

The Nipissing has started sinking with hand steel on its No. 3 area in Mountbray. This work will be continued until the new plant is erected.

Development in the Gaspe zinc district has been held up on account of the delay in installing the compressor plant.

The Wright-Hargreaves mine of Kirkland Lake, is increasing its milling opertions to 500 tons a day, which is an increase of approximately fifty tons. Some minor changes have been made in the mill, but these are only preparatory to extensive remodeling, which will permit the treatment of approximately 700 tons a day. A new air compressor has been installed, which will permit the use of several more drills. It is planned to open up a large area of promising territory lying between the Lake Shore boundary and what is known as the west fault of the Wright-Hargreaves.

An electrical survey is being made on the Potterdoal property, in Munro Township. Some work which has already been done with a dip needle indicates a considerable extension of the mineralized zone. Diamond drilling is also being used. The holes, which to date have been drilled to a depth of approximately 300 ft., show the continuance of the vein. Four diamond-drill holes have been put down, but these do not cover a much greater distance laterally than was indicated by the surface exposure. The company is capitalized at 3,000,000 shares, of which 2,227,456 are issued. It also has $103,000 in reserve.

Activity in the Kamiskotia copper area, northwest of Porcupine, still continues. Since last November 4,000 claims have been recorded. The question of assessment work is complicated to some extent by the fact that this area lies within the timber limits controlled by the Abitibi Paper Co.

Alaska Juneau in March

Alaska Juneau in March, 1927, mined and trammed 375,000 tons of ore, yielding $190,500; this was a gross return of 50.8c. per ton. Operating expenditures totaled $198,250, or 52.87c. per ton. The operating loss was $7,750, or 2.07c. per ton. Other expenditures and accrued charges of $20,000 increased the deficit to $27,750 for the month.

Melbourne Letter

By Peter G. Tait

Special Correspondent

Port Lincoln Graphite Deposits to Be Worked—Interest in Tin Continues

Melbourne, March 17—A company, Graphite Ltd., has been formed in South Australia with a capital of £20,000 to work the graphite deposits near Port Lincoln, which was mentioned in our last letter.

It will be remembered that several years ago Amalgamated Zinc considered a proposal to embark on the paper-making industry in Tasmania, but for various reasons the proposal was dropped. D. Avery, one of the directors, however, personally followed up the proposal and was instrumental in obtaining from the Tasmanian Government some advantageous rights covering the supply of timber and other facilities, so much so, that the Amalgamated Zinc Co. has now decided to subscribe a minimum of £50,000 to a subsidiary company which will install a small paper-making plant capable of producing approximately a ton of paper per day. This plant, it is believed, will enable the company to carry out the experimental work necessary before proceeding with the installation of an up-to-date pulp and paper mill, which will call for an expenditure of perhaps £2,000,000. A minority of the shareholders expressed the opinion that the Amalgamated Zinc Co. should go into liquidation and distribute its assets, but it was pointed out that this could not be done, as the company's main assets are patent rights in the Mineral Separation and De Bavay's Processes Pty., Ltd., which are bringing in a good revenue and which the company practically has to hold.

Guinea Gold, Ltd., the Adelaide company which is operating in New Guinea, is now installing a small hydraulic sluicing plant on one of its leases. This plant, which was built in Australia by Thompsons Engineering & Pipe Co., has no part exceeding 50 lb. in weight, which is the maximum that can be transported by the native carriers.

The Morobe Guinea Gold, N.L., is acquiring an adjoining area on the Bulolo River. With primitive appliances 3,500 oz. of gold were recovered from this area in four or five months. The former owner states that the labor of each boy employed produced 1 oz. to 1¼ oz. per day. There appears little doubt that some of the approved gold-bearing areas on the Edie Creek and Bulolo River are extremely rich, but the difficulties of operating in such country, where all supplies have to be transported over rough country by native carriers, appear formidable. The fact remains, however, that considerable quantities of gold are even now being obtained.

Tin mining in Australia continues to attract considerable attention. A recent flotation is the Sugarloaf Tin, N.L., in the Stanthorpe district, Southern Queensland. It is estimated that the tonnage available is 3,591,000 cu.yd.

Mexico City Letter

By W. L. Vail

Special Correspondent

Federal Government to Handle Labor Disputes—Chihuahua Considers New Tax Law

Mexico City, April 11—A recent decree, signed by President Calles and published in the *Diario Official*, says that in the future all labor disputes between workers and owners of mines and of oil properties, throughout the republic, will be handled by the federal government, in the City of Mexico, through the Department of Labor, Commerce, and Industry. This department has already communicated with the different state governments, notifying them of the presidential action and requesting their co-operation. In issuing the decree, the president explains that the change is made to prevent conflicts arising where labor disputes might occur simultaneously in different states, and be handled differently by different state authorities, without respect to the rights of residents of adjoining states. The decree is considered by some mine operators to be flagrant violation of specific articles of the constitution, and it is probable that representations to that effect may be made by certain groups and organized mining bodies.

The War Department has advised various mining chambers that responsible mining companies, associated with regularly recognized chambers, will be extended special considerations, in the securing of permits for the purchase and transport of explosives.

A new state-tax mining law for the State of Chihuahua will be presented by the governor to the state legislature for consideration at the meeting of that body on April 16. As the provisions are the result of an agreement between representatives of the Chihuahua Chamber of Mines and government officials, they probably will be adopted. Some of the clauses provide: that metallurgical plants shall pay taxes on production of arsenic, antimony, bismuth and some other minerals derived from minerals, and mineral substances, produced within the state, which have been made within the metallurgical plants, and on which producers have not already paid taxes; that the minimum fines for infractions shall, in some cases, be considerably reduced under the present schedule, and the maximum fines limited to 500 pesos; that payment of taxes may be made in the treasury of the state at Chihuahua city; that samplings and assays may be made by state officials, but at state cost, and only for their information, all settlements and liquidations to be based entirely on the assays and samplings of the federal officials; that facilities shall be given mine owners and metallurgists for the transport of their products.

Numerous denouncements of lead properties have recently been made in northern Chihuahua, south of the present workings at Tinaca Blanca, Tex., 38 miles southeast of Marfa. Construction work on the Kansas City, Mexico, and Orient Railway, from Chihuahua City to Ojinaga, is being pushed rapidly, and is stimulating prospecting in the adjacent territory. Ultimately, this road will be completed from Ojinaga to Alpine, Tex., making a continuous line from Kansas City to Topolobampo, on the west coast of Mexico.

Dissension as to the location of the boundary line between the states of Durango and Coahuila is expected to be settled soon. The disputed zone includes some highly mineralized country in the Sierra de Ramirez, now considered to be in the State of Durango, but claimed for many years by the State of Coahuila. A decision would lead to numerous denouncements of properties in the Sierra de Ramirez.

The annual report of the management of the Natavidad Mining Company, Oaxaca, which was operated last year by the Peñoles company under a working option, appears to be satisfactory. According to the report, the new mill was put into operation Sept. 1, 1926. It has a capacity of 150 tons daily. The report states that the gold recovery made averaged 95 per cent, and the silver recovery 88 per cent.

Machinery for the Chontalpan mines, Guerrero, recently purchased in Los Angeles, Calif., is beginning to arrive. It is expected that the new plant will be in active operation by the end of the present year.

Ore Shipments to Trail Smelter 9,384 Tons, April 1-7

The Consolidated Mining & Smelting Company of Canada, Ltd., reports the following shipments of ore received at the Trail smelter during the period of April 1 to April 7 inclusive:

Mine	Class	Locality	Tons	
Allenby	Cu. concentrates	Allenby, B. C.	842	842
Bluebell	Milling ore	Riondel, B. C.	748	
Caledonia	Milling ore	Blaylock, B.C.	34	
Lucky Jim	Milling ore	Zincton, B. C.	737	
Noble Five	Milling ore	Sandon, B. C.	65	
Paradise	Milling ore	Lake Windermere B. C.	54	
Ruth Hope	Milling ore	Sandon, B. C.	79	
Yankee Girl	Milling ore	Ymir, B. C.	439	2,156
Last Chance	Dry ore	Republic, Wash.	334	
Lone Pine	Dry ore	Republic, Wash.	32	
Quilp	Dry ore	Republic, Wash.	523	
Surprise	Dry ore	Republic, Wash.	108	997
Company mines			5,389	5,389
Total			9,384	9,384

New Development Work at St. Eugene Mine

The Consolidated Mining & Smelting Company of Canada, which has been doing a considerable amount of exploration with a diamond drill at its St. Eugene mine, at Moyie, which in the early days of the company's operations supplied most of the lead ore for the Trail smelter, will follow up the drilling by development. Daniel Mathison, formerly superintendent at the company's Rock Candy fluorspar mine, has been placed in charge of the work at the St. Eugene. According to report, the road from the Aurora mine, on the opposite side of Moyie Lake to the St. Eugene mine, which has been blocked by snow, is now open. An experimental car of ore is being shipped from the Guindon mine, adjoining the Aurora property.

London Letter

By W. A. Doman

Special Correspondent

Conditions in China Affect Market —Union Corporation Issues Annual Report

London, April 5—Owing to the serious news from China, and the approach of budget time, interest in mining shares has waned. Naturally such influences should not check business, but everyone seems afraid of losing capital, and prefers to wait until the disturbing elements have passed. A few of the Kaffir shares are kept alive in order to allow certain people and companies to unload, but, despite encouraging statements of developments, prices are on the down grade. The most interesting items are the issue of the annual report of the Union Corporation, and the preliminary profit figures of the General Mining & Finance Corporation; both have done well. The former has had a record year, due largely to the San Francisco Mines of Mexico and the business connected with East Geduld Mines, though, as regards this particular mining company, the current year should show handsome profits, seeing that developments from the workings of the Geduld Proprietary are very satisfactory. The net profit of the Union Corporation after all expenses is £383,990; the dividend is made up to 5s. per share, or 40 per cent, for the year, and the reserve fund is raised to £429,328.

In addition to the San Francisco Mines of Mexico, promising results are being obtained in Mexico from development work on one of the Guanajuatillo group of mines. Nothing definite can yet be said concerning the results to be expected from the treatment of ore from the Bilbao property of the Compania Internacional Minera, S. A., as the mill was started on ore below average grade.

The General Mining & Finance Corporation, which presumably made the bulk of its profits from transactions in West Rand Consolidated shares, announces a net profit of £343,000 and pays a dividend of 17½ per cent. In this company there are 1,000 founders' shares of £1 each, and on these shares no less than £25,424 is distributed.

The Lena Goldfields Company, it is said, is experiencing difficulty in carrying out the terms of its contract with the Soviet Government.

Although the Rio Tinto company is the largest of the copper and pyrites mines in Spain, its annual reports contain little information. The report for the calendar year 1926 is now issued and shows a balance on revenue account, including a sum of £150,000 brought back from income tax suspense account, of £1,172,199, though this amount includes £481,153 brought in from 1925. Virtually all the mining information contained in the report is that operations in Spain have been carried on without interruption during the year, and that the output of mineral and production of copper have been satisfactory.

New Equipment at Gold Mine in Mysore, India

Nundydroog Mines, in Kolar Field, Completes Main Shaft After Twelve Years' Work

An important recent development at the Nundydroog Gold Mines, in the Kolar gold fields, of Mysore, India, is the installation of a new surface plant for the working of Henry's circular shaft. The new plant will be put into operation about July. Sinking and completing the new main shaft of the mine has taken twelve years—1914 to 1926. The shaft is 18 ft. in diameter, brick-lined throughout to a thickness of 18 in., and is sunk to the 48 level of the mine, which has a vertical depth of 4,300 ft. The shaft equipment includes steel byatts, which are made of channel iron, 9 in. by 3½ in., filled in with teakwood, and covered by steel sleepers. The byatts are spaced at intervals of 9 ft. 6 in. Rail cage guides, which weigh 83 lb. per yd., are laid on the byatts. The cage is double decked, and is 11 ft. 6 in. long by 4 ft. 4 in. wide, and 13 ft. 6 in. in height. It is capable of accommodating 60 men. The cage weighs 9,000 lb.; the combined weight of cage, 60 men, and 4,250 ft. of suspended rope is 23,715 lb. Maximum load when winding men will be 39,435 lb. The actual breaking stress of the rope is 286,720 lb., which gives the installation a static factor of safety of 7.27 when winding men. A tilting device, which is attached to the bottom deck of the cage, facilitates the exit and entrance of loaded trucks. This device is equipped with mechanical stops for keeping the trucks in position.

The shaft is surmounted by a steel headgear 80 ft. in height to the centre of the sheaves, which are 14 ft. in diameter. It is fitted with a five-ton traveling crane for lifting timber and other heavy material.

The winding plant consists of a winder and converter set. Double drums of the parallel cylindrical type, each drum being 14 ft. in diameter by 5 ft. wide, have been provided for the winder, which is driven by means of two continuous current motors, each of 1,100 hp., and coupled to each end of the drum shaft by a flanged coupling. The Ward-Leonard system of control is used. A direct-coupled, motor-driven, auxiliary air compressor, with receiver, operates the brakes of the winder if the mine air supply fails. The compressor is capable of operating the brakes under all conditions of load, and is so arranged as to start up automatically if the mine air fails or falls below a pressure of 35 lb. In addition to depth indicators, devices are provided for automatically controlling the acceleration of the winder motors, so that an over-wind is practically impossible.

The main object of this new installation is to work the Nundydroog mine at greater depths. The 48 level is taken as the starting point for the second stage; a main haulage level at this depth will be used over the entire extent of the property; three subsidiary shafts will be sunk to this level for development purposes.

Societies, Addresses, and Reports

Adjustment Committee of American Zinc Institute Makes Favorable Report at St. Louis Meeting

Smelters and Ore Producers Agree to Interchange of Statistics—Bi-monthly Report to Be Made on Smelter Metal and Ore Stocks—Interesting Paper by Richard Jenkins

By J. H. Wadleigh
(Special Telegraphic Report)

THE SMELTING INTERESTS have agreed to a complete interchange of statistics with the ore producers of the Joplin-Miami district, according to an announcement made by P. B. Butler, chairman of the adjusting committee, at the annual meeting of the American Zinc Institute held at St. Louis, Mo., on April 18 and 19. He stated that figures showing the average smelting cost of producing a ton of metal are now being compiled, and that in a short time the smelters would submit data on the average weighted selling price of metal.

Intensive Educational Campaign Planned

A comprehensive educational campaign for the promotion of the uses and advantages of heavily coated zinc sheets was advocated by F. C. Wallower, chairman of the galvanizing committee, and by C. F. Beatty, chairman of the publicity committee. Mr. Wallower recommended that the ore producers appropriate one cent on each ton of concentrates produced, and that the smelters appropriate two cents on each ton of metal produced, the revenue to be used to pay for the services of a representative to promote, among jobbers of galvanized sheets, the idea of better coated products. Mr. Beatty recommended that a sum of approximately $30,000 be raised by the institute for advertising heavily zinc-coated sheets in trade papers.

Retort smeltermen of the Middle West, buyers of zinc concentrates from the Joplin-Miami district, clearly indicated that they were apprehensive of the growing production of electrolytic zinc in the West. E. M. Johnson, manager of the Henryette plant of the Eagle-Picher Lead Co., brought the subject to the fore in his paper "Smelting of Zinc." He stated that, although the cost of producing electrolytic zinc was $3 to $4 per ton higher than the retort process per ton cost, the electrolytic process possessed the advantages of greater recovery and higher-grade metal produced. Dr. Charles H. Fulton, director of the Missouri School of Mines and Metallurgy, in commenting on Mr. Johnson's paper stated that he thought the electrolytic and electrothermic processes of zinc reduction would supersede the retort process within a few years.

C. L. Patterson, secretary of the sheet-steel extension committee, described the work the committee is doing in the interest of a better galvanized sheet.

One of the most interesting papers of those presented at the convention was that by Richard Jenkins, secretary of the Tri-State Section. The paper outlined the extensive welfare work in progress in the Joplin-Miami district.

Jesse G. Starr New President of Zinc Institute

Jesse G. Starr, of Joplin, president of the Quinton Spelter Co., was elected president of the American Zinc Institute to succeed A. P. Cobb, of New York, vice-president of the New Jersey Zinc Co.; Mr. Cobb was elected first vice-president. Julius W. Hegeler, of Danville, Ill., was elected second vice-president; John A. McCarthy, of New York, third vice-president; Howard I. Young, of Mascot, Tenn., treasurer; and Stephen S. Tuthill, secretary. The following directors were elected: P. B. Butler, Charles A. H. de Saulles, J. W. Hegeler, John A. McCarthy, W. A. Ogg, J. G. Starr, H. S. Wadner, and H. I. Young.

The following were appointed on the ways and means committee: Howard I. Young, Fred N. Bendelari, Jesse G. Starr, C. H. Klaustermeyer, L. E. Wemple, John A. McCarthy, John W. Newton, Julius W. Hegeler and Julian D. Conover.

April 19 Meeting of New York Section of A.I.M.E.

A meeting—a "motion picture evening," according to Sidney Rolle, who presided—was held April 19 by the New York Section of the American Institute of Mining and Metallurgical Engineers. A five-reel motion picture entitled "From Mine to Consumer," illustrating the mining and concentration of copper ore, the smelting and refining operations, and the manufacturing of the copper, bronze, brass and alloy final products, was shown through the courtesy of the Anaconda Copper Mining Co. and its subsidiary, the American Brass Co.

Preceding the picture W. H. Bassett, of the American Brass Co., reviewed the qualities essential to copper to meet the requirements of the current utilization of the metal.

Thomas F. Brophy, of the Anaconda company, in an interesting paper he presented following the motion picture, gave an outline of the work done by the copper industry, during the last six years, to promote increased consumption of the metal. He stated that new uses for copper were continually being developed as a result of the research work the industry is doing. He mentioned the manufacturers of radio equipment as recent large consumers of copper and copper alloys.

San Francisco Section Discusses Hydraulic Mining

Hydraulic mining was the chief topic of discussion at the April 12 meeting of the San Francisco section of the American Institute of Mining and Metallurgical Engineers. P. Bouery, who first addressed the meeting, briefly sketched some of his experiences as a placer and hydraulic miner. He made a forcible plea for the re-establishment of hydraulic mining, and expressed his opinion that this kind of mining could be profitably revived to some extent in California.

Major C. S. Ridley, of the California Débris Commission, the next speaker, spoke upon the relation of the California Débris Commission to hydraulic mining in the past and at present. He stated that the commission was making an investigation of the subject of the resumption of hydraulic mining for presentation to Congress. Probably the most significant part of Major Ridley's address was a series of questions and answers. In substance the questions were as follows: Can hydraulic mining be resumed upon an economic basis? What can the miners afford to pay for débris storage? What proportion of the cost of débris dams should the miners pay, and what are the probabilities of this repayment? Should the cost to the miners include interest upon the capital represented by the cost of the dams? What proportion of the débris resulting from mining will be retained by high dams? What proportion of the escaping silt will adversely affect the rivers and the bay? What slope is to be assumed for the débris settling in the dams? What allowance is to be made for débris stored in the mine? To what extent can the dams be used for power purposes? What effect will the construction of other dams between the hydraulic mine and débris dam have?

Arthur Jarman, the next speaker, said the assistance of the California Débris Commission was going to solve the hydraulic mining problem. He reviewed the subject and presented a number of lantern slides which illustrated some past and present conditions in hydraulic mining areas and tributary stream beds. He made a plea for some action toward hydraulic mining resumption.

James D. Stewart, of Auburn, Calif., a hydraulic miner, stated that he was born in Gold Run Ravine and had grown up with the hydraulic mining industry. He said: "I had rather given up the idea that any considerable mining could be done until about three years ago. Since that time I have addressed 204 meetings and have written 98 articles dealing with this subject." He commented upon the apathy of the mining fraternity and that of the people who are most interested in hydraulic mining, gave interesting bits of history about the beginning of hydraulic mining, and said that the quartz miners had just as much to do with the shutting down of the hydraulic mines as the valley people. "An injustice had been done to the hydraulic miners," he said, "and we believe we have a right to go to Congress to ask for aid to rehabilitate the industry." He skillfully answered the charge of paternalism brought up by the agriculturists, and complimented the California Débris Commission upon its impartiality in administering the provisions of the Anti-Débris Law. He eulogized H. C. Cloudman, who is endeavoring to obtain a state appropriation for the investigation of vital questions pertaining to hydraulic mining resumption.

The meeting was attended by more than fifty members and guests. General discussion of the subject advanced by the speakers closed the meeting.

Interesting Meeting Held by Columbia Section, A.I.M.E.

Columbia section of the American Institute of Mining and Metallurgical Engineers held its spring meeting in Wallace, Idaho, on April 8. From every standpoint — attendance, papers presented, and general discussion—this meeting was pronounced the best the section has held in many years. In the afternoon of April 8 a visit was made to the surface plants and mills of the Hecla and Morning mines. Saturday, April 9, was spent at the Bunker Hill & Sullivan mine and mills, the Bunker Hill smelter, and the electrolytic zinc plant being constructed by the Sullivan Mining Co.

H. G. Washburn, of Wallace, vice-chairman of the Columbia section, and assistant general manager of the Federal Mining & Smelting Co., was in charge of the arrangements for the meeting. Frank M. Smith, of Spokane, chairman of Columbia section, and director of the Bunker Hill smelter, presided. Preceding the formal program, the chairman called upon Dr. Francis A. Thomson, of Moscow, Idaho, dean of the school of mines of the University of Idaho, for a brief report of the annual meeting of the Institute held last February in New York, which he attended as the representative of Columbia section. Dr. A. E. Drucker, head of the department of mining and geology at Washington State College, Pullman, and Prof. Hugh M. Henton, chief geologist at the Pullman school, spoke briefly. Fourteen senior-year students in mining and geology at the institution attended the meeting; they were in the Coeur d'Alene district for several days, visiting the mines, mills, and smelter. L. K. Armstrong, of Spokane, secretary of Columbia section, spoke briefly on the work of the organization. The following formal papers were presented:

"The Galena Mill," by Roy McKinley. This paper dealt with the flotation plant recently constructed by the Callahan Zinc-Lead Co. at the Galena mine.

"General Geology of the Coeur d'Alene District and of the Morning Mine," by J. Edward Berg, assistant superintendent and chief engineer of the Morning mine, Federal Mining & Smelting Co. This paper led to considerable discussion on various features of Coeur d'Alene geology.

"Mining Methods at the Morning Mine," by C. E. Wethered, superintendent, and S. H. Fairweather, mining engineer, at the Morning mine. The paper was read by Mr. Fairweather.

"The Morning Mill," by M. P. Dalton, superintendent, and George S. Price, assistant superintendent at the Morning mill. The paper was read by Mr. Dalton. The Morning mill has recently been converted into an exclusively flotation plant of 1,200 tons' daily capacity.

The above-noted papers were presented at the formal meeting held in the Fremont restaurant. Ninety-five attended the meeting.

Annual Meeting of the Iron and Steel Institute

The annual meeting of the Iron and Steel Institute will be held at the Institution of Civil Engineers, Westminster, England, on May 5 and 6. Seventeen technical papers will be presented at the meeting.

The fall meeting of the Institute will take place at Glasgow during the period of Sept. 20-23. Sessions for the reading and discussion of papers will be held in the Royal Technical College.

U. S. Civil Service Examination

The U. S. Civil Service Commission announces an open competitive examination for the position of junior mining engineer. Applications must be on file with the Civil Service Commission at Washington, D. C., not later than May 14. The entrance salary is $1,860 a year. Full information and application blanks may be obtained from the United States Civil Service Commission, Washington, D. C., or the secretary of the board of U. S. civil service examiners at the post office or custom house in any city.

Michigan Engineers Will Visit Copper Country

At the invitation of Dr. W. O. Hotchkiss, president of the Michigan College of Mining and Technology at Houghton, the Michigan Engineering Society is planning a pilgrimage to the Michigan copper district this summer. Byron E. Parks, of Grand Rapids, has been named chairman of a committee to arrange the tour. The other members of the committee are George Fenkell, of Detroit; G. C. Dillman, of the State Highway Department, Lansing, and Dr. Hotchkiss.

Radioactive Ores Reported Found in Northern Transvaal

The U. S. Department of Commerce reports that a recent discovery at the Northern Transvaal (Messina) Copper Exploration Co.'s mine, in the Pietersburg district, of what was thought to be radioactive ore, has now been confirmed by qualified analysts, and it is asserted that, if extensive deposits corresponding to the samples are found, South Africa should become an important source of radium. Samples submitted to tests consisted of tintaniferous magnetite, horneblended, biotite quartz, and feldspar. Several specimens were found to be unusually rich in uranium, being similar to the pitchblende of the Belgian Congo. The company is preparing to investigate the extent of these deposits.

People You Should Know About

James A. Foley, a Salt Lake City mining man, has returned from a trip to California.

O. F. Riser, vice-president and manager of the National Equipment Co., is in Nevada on a business trip.

Jackson McChrystal, Eureka operator, has returned to Salt Lake City after a three months' visit to California.

C. V. Drew has been elected a director of the Cerro de Pasco Copper Corporation, to succeed **A. W. McCune,** deceased.

Amor F. Keene, consulting mining engineer, announces the removal of his office on May 1 to 26 Beaver St., New York City.

J. E. Mills-Davies delivered a lecture on "Scientific Prospecting" at the April meeting of the Transvaal Prospectors' Association.

Dr. Gevers, Government Geologist of the Union of South Africa, has left Pretoria for Molten, in Cape Province, on field work.

A. G. Kirby, mining and metallurgical engineer, announces the removal of his offices to Angels Camp, Calaveras County, Calif.

L. S. Cates, vice-president and general manager of the Utah Copper Co., visited the Ray mine, at Ray, Ariz., during the first week of April.

Lucien Eaton, superintendent of mines in the Ishpeming, Mich., district for the Cleveland-Cliffs Iron Co., is looking over mines in Arizona.

Charles Hardy, president of the Associated Metals & Minerals Corporation, sailed from New York for Europe on April 23 on a five weeks' business trip.

C. F. Kelley, president of the Anaconda Copper Mining Co., sailed from New York for Italy on April 14. Mr. Kelley will probably not return before July 1.

D. L. Forrester, mill superintendent of the Old Dominion Copper Co., and inventor of the Forrester flotation cell, visited Salt Lake metallurgical plants recently.

W. J. Hosking, engineer of the Tough-Oakes Burnside, has resigned his position to become engineer for the Granada, operating in the Rouyn area of Quebec.

A. H. Lawry, superintendent for the Goldfield Consolidated Mining Co. at Goldfield, Nev., has returned to Goldfield from a business trip to San Francisco.

Adolph G. E. Hanke, New York capitalist and director of the Park Utah Consolidated Mines Co. has been making an inspection of the Park City, Utah, properties of the company.

Thomas Rule, of Port Arthur, has been engaged by the Red Lake Mines, Ltd., as mine manager of their property in the Woman Lake section of the Red Lake area of northern Ontario.

H. D. Miser, of the Geologic Branch of the U. S. Geological Survey, after a two weeks' conference with Oklahoma geologists, is now engaged in field work, with headquarters at Talihina, Okla.

Walter R. Knox has been appointed mine manager for the Churchill Mining & Milling Co., which has decided to resume operations on its property in the West Shining Tree camp of northern Ontario.

C. O. Lindberg, consulting geologist of Los Angeles, visited Salt Lake City and the Park-Bingham mine recently to confer with **H. C. Enos,** who has taken charge of operations at the Bingham mine.

Clinton R. Crane

Clinton R. Crane, president of the Mining and Metallurgical Society of America and president of the St. Joseph Lead Co., was in Cambridge, Mass., on April 12, and addressed the students in the mining and metallurgical department of the Harvard Engineering School, on present-day opportunities for technically trained men.

George A. Shaw, who was reported to have severed his connection with the Talache Mines, Inc., is still associated with the company and is for the present making his headquarters at Quartzburg, Idaho.

B. B. Thayer, vice-president, **Frederick Laist,** general metallurgical manager, and **Carlos Ryan,** of the Anaconda Copper company, spent several days recently conferring with International Smelting Co. officials.

C. W. Nicolson, mining engineer for the Cleveland-Cliffs Iron Co., Ishpeming, Mich., has departed for Alaska, where he will be in charge of drilling operations on a gold property for private interests during the summer months.

A. A. Baker and **E. T. McKnight,** of the Geologic Branch of the U. S. Geological Survey, left Washington, D. C., on April 8 to resume stratigraphic and structural field studies in the region around Moab, Utah. **J. D. Sears** left Survey headquarters on April 10 to join Mr. McKnight.

H. R. Condon, formerly an officer of the Pennsylvania Railroad Co., has been elected general manager of the American Mond Nickel Co., with headquarters in the Century Building, Pittsburgh, Pa. The Mond company is the selling agent, in United States, for nickel smelted by the Mond company in Ontario and refined in Wales.

W. S. Whitworth, manager of the Koffiefontein Mines, Ltd., Orange Free State, Union of South Africa, left the mining property early in March for Capetown on a month's holiday. After his return he will take up duties as manager of the Premier Diamond Mines, Ltd., in the Transvaal.

Obituary

A. B. Hall, president of the Nevada-Rand Gold Mining Co., was killed recently in a shaft accident at the company's St. Elmo mine, near Atolia, in the Randsburg district of California. Hall lived at Lone Pine, Calif.

Charles L. Herrick, of Mullan, Idaho, manager of the Gold Hunter Mines, Inc., died on March 25. Mr. Herrick was born in Hudson, Wis., on Nov. 6, 1868. He went to the Coeur d'Alene district forty years ago. In 1904 he became superintendent of the Gold Hunter mill, a position he held until 1917, when he was advanced to the post of manager of the company. He is survived by his wife.

John Randolph Farrell, who recently died at his home in Oakland, Calif., was a graduate of the University of California, 1874, and at the time of his death was employed by the East Bay Municipal Utility District. One of his most noteworthy feats was an early investigation of the mining possibilities of the Katanga area, in Africa. For this work, which was the first technical investigation of the region, he was awarded a decorative honor by the Belgian Government. His mining work took him to Africa, South America, and Mexico.

A. W. McCune, pioneer Utah mining man—developer of the Cerro de Pasco, the Payne, the Poor Man, and other rich mines—died at Cannes, France, on March 28 at the age of seventy-eight. Born at Calcutta, India, the son of a British army officer, Mr. McCune went with his parents, who joined the Mormon Church in September, 1857, to Utah. From a farm boy and teamster he rapidly advanced to the position of a contractor. One of Mr. McCune's most remarkable achievements was the cutting of 1,300,000 cords of wood for the Anaconda Copper Mining Co. From the Payne mine, situated in the Slocum district of British Columbia, he made a fortune of several millions. Other mining ventures, among them the Poor Man mine, enhanced his wealth. His promotion of the Cerro de Pasco mine, in Peru, involving the investment of more than $20,000,000 and the enlistment of the aid of such men as Haggin, Hearst, J. Pierpont Morgan, and others, was Mr. McCune's most noted exploit. He is survived by his two sons, Raymond and Marcus, and by three daughters, Mrs. Betty Trower, Mrs. Fay Naylor, and Mrs. Jacketta Quealy. Burial will be at Nephi, Utah.

Lack of Invention Shown in French Patent on Electrolytic Zinc

Many Prominent Metallurgists Testified in Recent Montreal Court Action Affecting Anaconda and Consolidated M. & S. Companies

THROUGH the courtesy of S. G. Blaylock is presented the following short summary of the events leading up to the impeachment suit of the French electrolytic zinc patent, and an abstract of the findings of Justice Audette, of the Exchequer Court of Canada, brief mention of the decision having appeared in "Engineering and Mining Journal" of March 12:

In June, 1924, French's Electrolytic Zinc Process Co. sued, in the Quebec courts, the Consolidated Mining & Smelting Co. for $8,000,000, for the alleged infringement of a Canadian patent covering the production of electrolytic zinc. This was followed almost immediately by an action in the Exchequer Court of Canada by the Electrolytic Zinc Process Co. (a Montana corporation) for a declaration that French's alleged patent was invalid because of prior art, and on other grounds. The Electrolytic Zinc Process Co. holds the zinc patents of the Anaconda Copper Mining Co. and the Consolidated Mining & Smelting Co., and licenses these companies and others to use them. Proceedings halted in the Quebec action pending the result of the suit in the Exchequer Court.

At the trial of the impeachment action brought by the Electrolytic Zinc Process Co. held in Montreal, commencing Feb. 8, 1927, and finishing with the judgment on March 4, evidence was given by the principal electrolytic zinc experimenters and operators of Europe, Australia, United States, and Canada, tracing the history of the electrolytic zinc art from its commencement with the Letrange process in 1880 to its present stage of development as shown by the operations of the Electrolytic Zinc Co. of Australia; the Anaconda Copper Mining Co. of the United States, and the Consolidated Mining & Smelting Co. of Canada.

The witnesses called by the plaintiff company to show the prior art and the lack of utility of the patent being impeached consisted of the following eminent zinc metallurgists:

E. A. Ashcroft, of England, who described his work of 1897 at Cockle Creek, New South Wales.

S. O. Cowper-Copes, of England, who had done similar work between 1897 and 1899 at Hayle in Cornwall.

Stanislav Laszczynski, who had operated at Miedzianka, Poland, and at Heilingenstaht, Austria, commencing about 1900.

Dr. Viktor Engelhardt of the Siemens & Halske Co., Charlottenburg, Germany, who has been for over thirty years contributing largely to the electrolytic zinc art.

G. H. Clevenger, of Boston, who was largely instrumental in the discovery of cobalt in the zinc sulphate solutions obtained from the Broken Hill ore, of Australia, and also in the problem of getting rid of this cobalt.

Dr. W. R. Ingalls, of New York, who for many years has been a prominent authority on zinc metallurgy, both electrolytic and otherwise.

Harry Hey, of Melbourne, Australia, chief metallurgist for the Electrolytic Zinc Co. of Australia, Ltd.

R. B. Caples, of Great Falls, Mont., assistant general superintendent of the Anaconda Copper Mining Co.

S. G. Blaylock, of Trail, B. C., general manager of the Consolidated Mining & Smelting Co.

The last three witnesses represented the only three important electrolytic zinc plants of the world today.

The following witnesses were called by the defendant:

W. E. Harris and Samuel Field, both of London, who were operating a small electrolytic plant at Llamsamlet, in Wales, during the latter stages of the war.

Charles S. Witherell, consulting metallurgist, of New York, and formerly on the staff of the Guggenheim Smelting & Refining Co.

E. P. Mathewson, well known in metallurgical circles on this continent, and now head of the department of mining administration at the University of Arizona.

J. O. Patenaude, of Nelson, B. C., president of the defendant company, the French Complex Ore Reduction Co.

Thomas French, of Spokane, the son of Andrew Gordon French, the inventor of Canadian Patent No. 140,402, which was under attack.

The trial was heard by Justice Audette of the Exchequer Court of Canada. Counsel presenting the plaintiff's case were W. N. Tilley, K. C., of Toronto; Aime Geoffrion, K. C., of Montreal; R. C. Crowe, of Trail, B. C., and A. W. Langmuir, of Toronto. Counsel presenting the defendant's case were Russel S. Smart, K. C., of Ottawa, and Henri Gerin-Lajoie, K. C., of Montreal.

The following extracts from the judge's opinion are of interest:

"In considering the prior art, and more especially the pioneer patents of Letrange, Lake, Cowper-Copes, Siemens and Halske, and others who followed up to the French patent, which, under some evidence, appear to be embodied in the latter in some manner or another, as explained by Dr. Ingalls, it would seem that the words of Lord Lindley are especially apposite when he says:

"'A patent for the mere use of a known contrivance without any additional ingenuity in overcoming fresh difficulties, is bad and cannot be supported. If the new use involves no ingenuity, but is in manner and purpose analogous to the old use, although not quite the same, there is no invention.'

"If French's process, as explained in the specification, is to be found in the prior art as contended by Dr. Ingalls, it becomes not an invention but a mere aggregation.

"There is even no invention in a mere adaptation of an idea in a well known manner for a well known purpose, without ingenuity, though the adaptation effects an improvement which may supplant an article already on the market. Besides the evidence on commission on behalf of both parties, and more especially the all important testimony of the chemist Engelhardt, I have had the advantage to hear as part of the plaintiff's case, men, I might say, the most qualified to speak upon this subject matter in our days; some of them, however, are officers of the plaintiff company—a matter I do not overlook. The most prominent experts heard on behalf of the defence appear to me to be men who were not quite sure of the ground they were treading upon, with, however, the exception of one of them whose testimony was especially theoretical, and of sweeping authority in his own estimation, mitigated by Exhibit 68, his letter to Mr. Stewart. I speak of the son of the patentee, who is interested in the defendant company as one of its directors. The witness Witherell's experience upon the treatment of zinc orginates with the present case, and his laboratory experiments filed of record were so materially criticized in rebuttal, that they are left bereft of much use to the court. The witness Mathewson has no operator's experience, and is without the knowledge acquired by experiments or personal practice in electrolyzing zinc; his fees, as witness, are controlled by the result of the present case to the extent of 2½ per cent on the net recovery of the patent. Some parts of his testimony, however, certainly confirm the views I entertain as to the want of novelty and invention in the patent in question.

"All these eminent chemists and metallurgists were called on each side, and the two sides do not agree—therefore in this conflict of testimony I am not only at liberty, but I am bound to exercise my own judgment, and that judgment agrees with the weighty evidence of the plaintiff.

"Dr. Ingalls, a witness of unusual knowledge and experience in the metallurgic art, has described and considered with great competence, every substantial allegation in the defendant's patent, and has demonstrated and established beyond any doubt that each and every one of them has been anticipated and belongs to the prior art. There is, according to his views, not one single element of the patent which is not found in the prior art.

"No purification is mentioned in the patent, and it is in the evidence that purification is said to be necessary. Moreover, no precise or definite quantity of manganese to be used is mentioned in either the specifications or the claims, which are drafted in such a way that such use may be extended or contracted as occasion might arise in the interest of the patentee. And it must be noted that this is done with respect to the use of a complex ore which already contains manganese.

"If there is anywhere in the claims a statement showing that the adjusting of manganese sulphate in the solution would affect the toxic impurities, I fail to plainly see it. The patent does

not show that the impurities must be taken out, although Mr. T. French, in his letter, Exhibit 68, propounds purification.

"The specification of a patent for a process must point out clearly the method by which the process is to be performed so as to accomplish the object in view: if it does not, it will be a statement of principle or discovery only, and the patent would be bad. It must indicate the essence of the invention and not be a mere prescription.

In the case of Yates vs. Great Western R. W. Co. it was held although the patented article was a most useful contrivance it could not be the subject of a patent, as it was wanting in the element of invention.

"I find that the defendant's patent does not possess any element of invention and I can, in no sense, find any creative work of an inventive faculty which the patent laws are intended to encourage and reward.

" . . . I cannot overlook the important fact that this patent, dating back to May, 1912, has only up to date (it has only three years to run) been experimented upon in laboratories and otherwise, and that it has never been used commercially. That, coupled with the evidence above referred to, shows if such a patent were maintained any longer, that an intolerable nuisance would arise, amounting to a serious impediment in the development of the art and trade in the metallurgic treatment of zinc mentioned in the case.

BASIS OF "NO INVENTION" DECISION

" . . . It is prima facie evidence of want of utility if the patented article has never been put into practice. Utility being one of the cardinal requirements for the validity of a patent would make these findings quite apposite. . . . This patent has been in existence for practically fifteen years, has been helped by the B. C. Government by a sum of $65,000 and has never been put into practice.

"Looking to what was known and published at the date of the defendant's patent, there was no invention in the process. As most of the zinc ores contain manganese, the patentee cannot claim the right to limit to himself the use of a solution containing manganese. And the question of fixing the proportion of manganese to be used does not amount to ingenuity of invention—however valuable it may be, and it is not defined in the patent.

"Free from all the verbiage of the evidence, it cannot be found that there was invention in the present case. Indeed it does not follow that the use of manganese claimed by the patent lay in a discovery based on a new invention. Is it a mode of treating zinc by increased skill arising from what can be no more than improvement in the technical art of metallurgy? The weight of the evidence answers that in the negative. The use of manganese as mentioned in the patent, I am unable to take as a patentable improvement under the circumstances.

"Therefore the defendant's patent, No. 140,402, is hereby adjudged and declared to be invalid, null and void for the reasons above mentioned. The whole with costs."

Recent Technical Publications

Reviews, Abstracts, and References

A New Mines Handbook

The Mines Handbook. Vol. 17 (1926). By Walter Garfield Neale. The Mines Handbook Co., 8 West 40th St, New York City. Price $15.

The last volume of "The Mines Handbook" under the editorship of Walter Harvey Weed appeared two years and three months ago. Since then, Mr. Weed has sold the publication with which he had been identified and joined the staff of the notorious George Graham Rice. The new editor is Mr. Neale, The Mines Handbook Co. still being the publishers, though this company is now controlled by Cameron, Michel & Co., "copper investment specialists, engineers, and operators," of New York.

Mr. Neale has followed closely the footsteps of his predecessor in the revision of the volume. As usual, there are given the name and address, names of officials, situation and description of property, development done, equipment, production, and financial statistics. Close to 10,000 companies are recognized, thus necessarily including many that own mere prospects, or that are now dead. The selection is confined to non-ferrous mining companies operating in the two Americas. The editor's comment on many of the properties is appended, following a custom of Mr. Weed's; in fact, Mr. Neale appears to have been even more liberal in his comment than the former editor. In these comments he has evidently been an optimist and played safe, refraining from saying many disagreeable things that might have been revealed concerning some companies.

The text has been entirely reset, the appearance of the book is good, and there is every indication that Mr. Neale has done an excellent job. The book has already won for itself a place in the reference library of every company and individual who has use for the data which it presents, and the latest volume will no doubt be as indispensable as the others have been.

E. H. ROBIE.

Employment Statistics for the United States.—A plan for their national collection, and a hand book of methods recommended by the Committee on Governmental Labor Statistics of the American Statistical Association. By Ralph C. Hurlin and William A. Berridge. Published by Russell Sage Foundation, 130 E. 22 St. New York City. Price $2.50.

Bearing a warning to American industry that a business slump and widespread unemployment following a protracted period of prosperity (such as the present) can be avoided only by careful management and through accurate current knowledge of industrial conditions, the 200-page report on "Employment Statistics for the United States," just issued by the Russell Sage Foundation in co-operation with the American Statistical Association, presents a comprehensive plan whereby not only the major industries, such as manufacturing, mining, transportation, communication, and agriculture, but industry and commerce in general may be furnished with a guide toward the prevention of overproduction and overextension of credit, the principal causes of business slumps and extensive unemployment. The plan presented calls for the collection of employment statistics by state labor bureaus, with the U. S. Department of Labor the coordinating center. In addition, the plan commends and urges the extension of the regular collection of employment statistics by federal bureaus having a direct relation to certain industries, such as the Geological Survey for mines and quarries, the Interstate Commerce Commission for railroads, and the Department of Agriculture for farms, and the reporting of all these data to the Federal Bureau of Labor Statistics for prompt publication of national indices of employment.

R. M. DAVIS.

Mining Camp Yarns. By Walt. (Raggs) Holliday. Published by Walter Holliday, P. O. Box 1708, Butte, Mont. Price, $1.

One, though not the only, merit of this little volume is that when it talks about mines and mining the language used is intelligible to a miner. Most writers of mining stories know so little of underground operations and the vernacular of the miner that the reader seldom knows what the author is trying to say. Mr. Holliday knows the miner's life below the collar of the shaft and above it. He is not an O. Henry, but he has a knack for telling a story; he has his own philosophy of life, and apparently he is a keen observer. The book is entertaining reading.

California Mineral Production — Bulletin No. 97 of the California State Mining Bureau, Ferry Building, San Francisco, is a 172-page statistical review of Californian mineral production for 1925. Products of greatest value were, in order, petroleum, cement, stone, natural gas, gold, brick and tile, copper, silver, granite, borates, and mineral water, the production of each of which was valued at more than a million dollars.

Breaking Rock by Heat — "Heat-Treatment as an Agent in Rock Breaking" is the subject of a 16-page paper by Bernard W. Holman published in the January *Bulletin* of the Institution of Mining and Metallurgy. Interesting experiments are described showing how rock may be heated and quenched and thus made exceedingly friable. Copies of the paper are obtainable for 1s. each from the Institution, Cleveland House, 225, City Road, London, E.C. 1, England.

Illinois Geology—The State Geological Survey, Urbana, Ill., recently issued a list of publications on the geology of Illinois, pp. 44, which list will be supplied by the Survey on request.

New Machinery and Inventions

The Lewis Traveling Cantilever Girder as Used at Moffat Tunnel

THE Lewis traveling cantilever girder was designed to meet the need of quicker and cheaper bench excavation in soft ground, as well as to provide a means of holding the wall plates and ribs up in their original position during the operations of excavating the bench and placing the plumb posts in place, a problem frequently confronting the tunnel engineer. George Lewis, general manager for the Moffat Tunnel Commission, is the inventor and designer of the new device, which is operating successfully with a saving in both time and costs, at both the east and west portals of the Moffat tunnel.

In driving this tunnel a method similar to the twin headings is used. The main railroad tunnel, 16x24-ft. in cross section, is paralleled by the 8x8 ft. water tunnel, 75 ft. south. The water tunnel is to be used, when completed, for carrying water under the Continental Divide from the western to the eastern slope. It has now been completed from the east to the west portals, the entire length of the bore, 6.1 miles, affording rapid transportation and furnishing many points of attack for driving in both directions, along the line of the railroad tunnel.

At this writing the distance between the two railroad headings is about 1,000 ft. At convenient distances of about 500 ft. crosscuts are driven from the water tunnel to the line of the railroad tunnel heading. The bottom of the water tunnel being on a level with the bottom of the railroad heading, all transportation to and from the heading is through the water tunnel.

Following the driving of the heading comes the widening to the full width required for the railroad tunnel, after which the wall plates, ribs, and lagging are placed. The ribs are thoroughly blocked at each joint, and all open spaces between the lagging and the surrounding rock are filled with either rock or cordwood packing. After this work is completed a bench 16 ft. in height remains to be excavated.

The predominating rocks are schists and gneisses. The constituent minerals are largely biotite, talc, and chlorite. All of these are soft and structurally weak. The formation is broken by faults and fractures, many of the seams being slickensided. Where this rock is saturated with water, it frequently runs so freely that hay or other similar material is required to check its flow.

Prior to the installation of the Lewis traveling cantilever girder, two different methods were used in supporting the wall plates and roof during the excavation of the bench. The first was by use of rakers or temporary posts set on an angle under the wall plates. These were removed as soon as the permanent posts were set. This method interfered with mucking operations and did not hold the wall plates in place.

The I-beam system was then tried. This consisted of I-beams held up by longitudinal girders, which themselves were supported at one end by crossmembers bearing on the wall plates of the completed timbering, while the other ends rested on the unexcavated bench. This method also failed to hold the wall plates and roof in position and was clumsy in operation. Neither of these methods was satisfactory. The work was cumbersome, slow, and costly, and the wall plates and roof settled to a point where they encroached on the neat lines of the tunnel.

In places the bench was so soft that it was taken out in two 8-ft. sections, a slow, unsatisfactory process. The Lewis traveling cantilever girder, shown in the accompanying drawing, was designed by Mr. Lewis to overcome the objections present in the systems mentioned and to speed up the work. The device essentially consists of two parallel 3½-ft. plate girders, 60 ft. long, spaced on 6-ft. centers with the necessary cross frames and bracing. This is carried on two pair of dollies, with ball-and-socket joints, permitting guiding of the girders and rolling on a 15-in. I-beam track, laid on 12x12-in. stringers. Arms extending horizontally from the girders and at right angles to them are suspended from the overhanging end of the beam. These arms are provided with a positive horizontal and vertical movement. The design shown in the accompanying drawing weighs approximately 98 tons.

In operation, the cantilever girder is on the track laid on the top of the bench in the completed section of the tunnel. The forward end of the girder is blocked against the roof timber by means of I-beam and powerful jacks. The arms are rolled out from the rear end of the girder under the wall plates, and are then blocked horizontally, preventing the wall plates from moving in. The entire arm is next raised vertically by means of a special steel wedge, which is operated by a rod with a right and left hand thread, until the weight of the wall plates and roof timbers is carried by the girder. Section *A-A* in the drawing is an end view and shows the arms extended, supporting the wall plates and roof timbers.

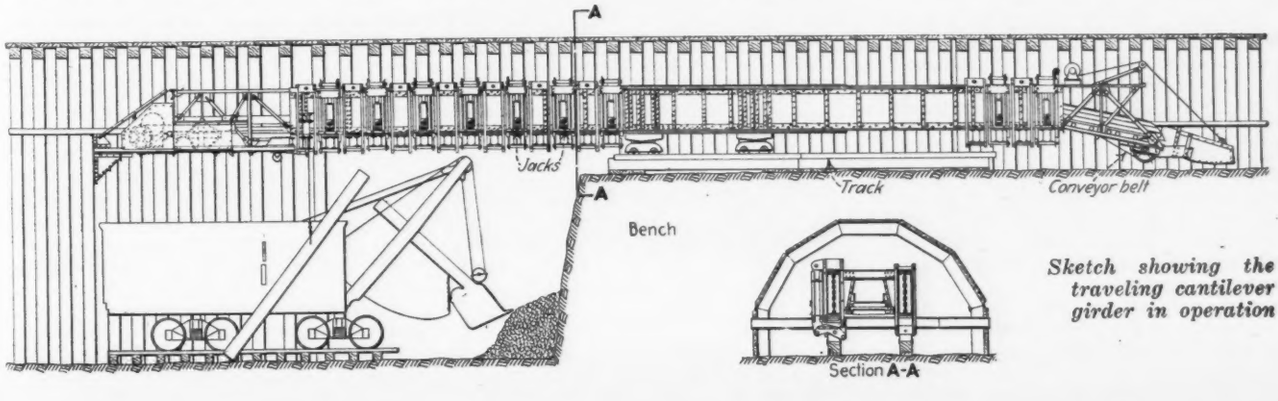
The device at the end of the girder shown in the drawing over the words "conveyor belt" is a loading attachment. Broken rock in the path of the girder not already removed is shoveled into the hopper and dumped back on the conveyor belt by means of the cable attached to the air hoist shown above the attachment. The material is carried on the belt through the center of the girder to the rear end, where it drops into the empty cars. The belt is operated by a small electric motor attached to the girder but not shown in the drawing.

When the girder is blocked in place as described in the foregoing paragraph, the bench is then drilled and blasted. The broken rock is mucked out by a one-yard Osgood shovel, operated by compressed air, working under the overhanging end of the girder. The plumb posts are next raised into place by the air hoist mounted on the rear end of the machine.

Under the I-beam system it was not considered safe to remove more than 6 ft. of bench at one operation. Under the new Lewis traveling cantilever girder system, 17-ft. rounds are being drilled and blasted and the mucking operations are carried on with ease and safety.

Thus, in one cycle of operations a section of bench 17 ft. long is removed and the permanent plumb posts are set. The girder is then moved forward on its track, this being accomplished by the use of another air hoist mounted on the forward end of the machine.

The time required for one cycle of



Sketch showing the traveling cantilever girder in operation

operations has been reduced from twenty-four to eighteen hours.

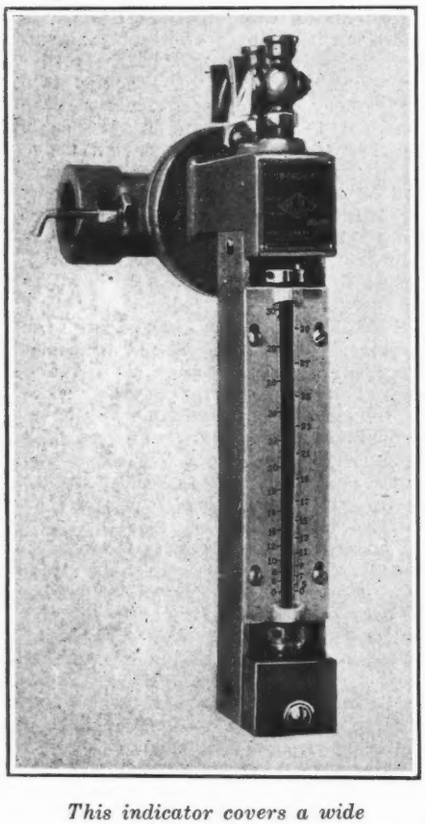
This device has not only speeded up progress and greatly reduced costs, but absolutely holds the wall plates and arches in their true position while the bench is being excavated and the plumb posts are set in place.

The data here given have been supplied by James F. Cohig, resident engineer, West Portal, Colo.

Simplicity Is Feature of New Flow Indicator

The illustration shows a type of flow indicator designed to measure the flow of either gas or liquids under practically all conditions and in any unit.

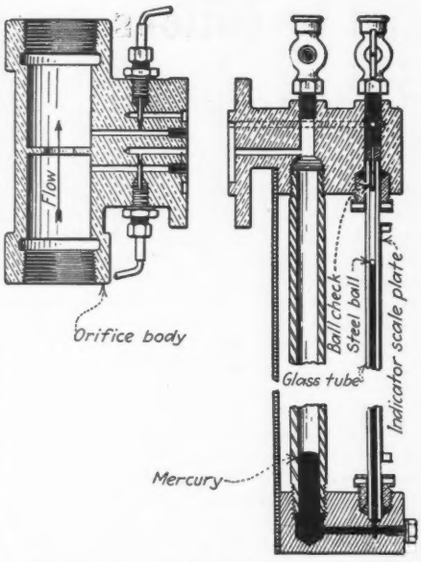
This instrument combines the well-known orifice and U-tube principles. It



This indicator covers a wide range of flow

is made up with a long scale plate to cover a wide range of flow.

According to the manufacturers, a feature of the instrument is the provision made to prevent the mercury blowing over. This is accomplished by floating a steel ball on the surface of the mercury in the indicating tube. In the event of the instrument being suddenly overrated or if undue pulsation takes place, the ball comes to rest against a seat and holds the mercury in the tube. Needle valves are provided in the orifice body so that the indicator may be removed or repairs or adjustments made without draining the line. Where the indicator is to be used for stream-flow indication, a small condensing reservoir is inserted in each line to the indicator to keep the connecting lines full of water.



Convenience and simplicity in design

The instrument is manufactured and distributed by Morey, Jones & Lovell, 810 West Sixth St., Los Angeles, Calif.

Improved Condenser Tube Cleaner and Gun

An improved type of condenser tube cleaner and a gun for holding the nozzle in the tubes when using high-pressure water are recent additions to the condenser cleaning equipment put out by the Condenser Cleaners Manufacturing Co., 422 First Ave., Pittsburgh, Pa.

The improved cleaner shown in Fig. 1 is fitted with a number of specially formed scrapers, *A*, which fit the tube closely and tend to shave the deposits from its surface.

The gun shown in Fig. 2 is designed for use in cleaning large condensers where the head is not removed and where high-pressure water is necessary to force the cleaner through the tubes. The operation of the gun is as follows: The nozzle *B* is placed in the end of the tube and when the water is turned on at the cock *C*, a piston in the cylinder *D* moves out until the extension *E*

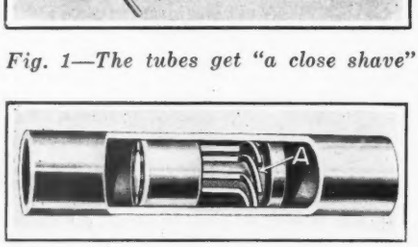


Fig. 1—The tubes get "a close shave"

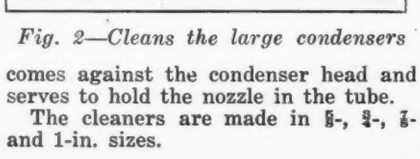


Fig. 2—Cleans the large condensers

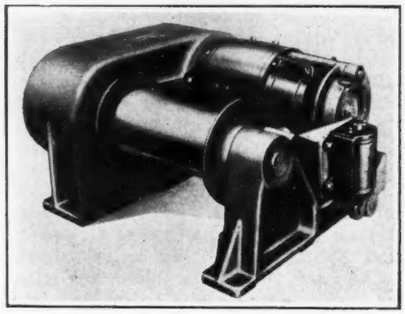
comes against the condenser head and serves to hold the nozzle in the tube.

The cleaners are made in ⅝-, ¾-, ⅞- and 1-in. sizes.

This New Electric Hoist of Varied Application

A new electric hoist that can be mounted in a fixed position, either overhead or on the ground, or can be placed on skids and used as a portable hoist, has been introduced by the American Engineering Co., of Philadelphia. Uses for the hoist, which is known as the "Lo-Hed," include applications to all sorts of lifting and hauling that can be done with a hoist in a fixed position.

The standard machine consists of a smooth drum, driven by a motor through a train of spur gears, all



A hoist that requires low headroom and can be used in several ways

mounted on a common bedplate. It is furnished in sizes for handling loads from 500 to 4,500 lb. Motor and gears are completely inclosed. Gears are of drop-forged steel, heat-treated and run in an oil bath. Hyatt "high-duty" roller bearings are mounted on the ends of all gear shafts. The cover of the gear case is easily removable.

The drum has large flanges which prevent the rope from jumping the ends and give maximum stowage capacity. One bearing of the drum shaft is lubricated by splash from the gears and the other by an Alemite fitting. The motor is fully inclosed, is ball bearing, and is especially designed for hoist service. Either d.c. or a.c. motor can be furnished. The controller is of the single-speed, reversing-drum type.

When desired, various modifications in the hoist can be made, such as supplying grooved drums, air motors or steam motors, push-button and remote control, holding and lowering brakes, and extension shafts with additional heads.

Variable-Speed Reducing Unit Attains High Efficiency

To meet the increasing demand for variable-speed drives for conveyors, cement mills, machine tools and other machinery requiring adjustment of speed, William E. Simpson, of 100 Morgan Building, Detroit, Mich., is putting on the market a new line of speed reducers which embody, in a single compact unit, a variable-speed drive.

Each unit comprises two reductions only, the first being a modified worm movement with variable ratio, and the second a train of heavy spur gearing adapted to take the high torque and shocks of the slow-speed end.

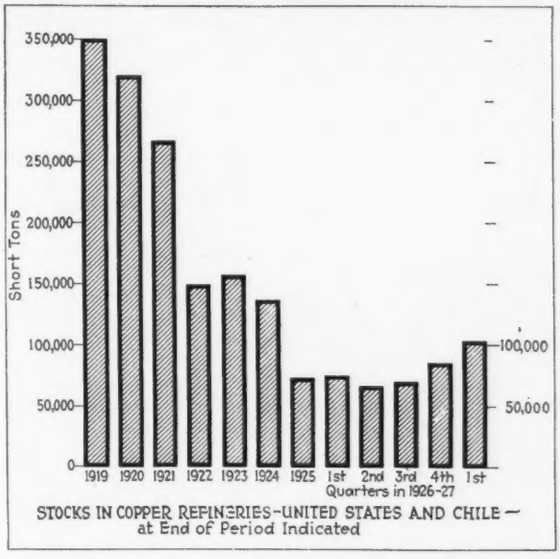
Market and Financial News

March Statistics Brighten Outlook for Copper

By A. B. Parsons
Associate Editor

THE average price of copper, f.o.b. refinery, during the first quarter of 1927 was 12.917c.; and, as this is written, on April 20, the metal is bringing still less. This price may fairly be described as unreasonably low.

It is true that the average price of all commodities has been declining steadily in recent years. Taking the major non-ferrous metals as a group, they have not fared badly; they are, in fact, relatively higher than in the period from 1922 to 1924. But copper has declined out of proportion



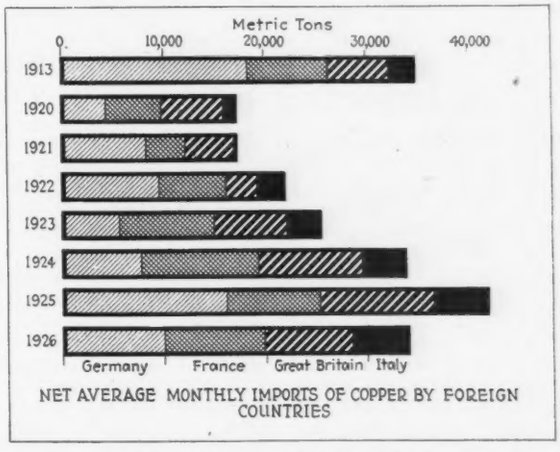
STOCKS IN COPPER REFINERIES—UNITED STATES AND CHILE—at End of Period Indicated

both to the general commodity level and to that of the other metals.

Also, it is true that during 1926 many of the large copper-mining companies did well in the matter of earnings and profits. However, considering the small companies as well as the large, and the industry as a whole, 1926 can hardly be said to have been a really prosperous year. Moreover, the average price for the year was 13.795c. at the refinery, between which and 12.917c. is a difference of 0.878c. A margin of this size would mean a difference in net annual income of about $28,000,000 for the copper-producing group, in which, of course, American companies have the pre-eminent place. In other words, if the price of copper should average during 1927 no higher than it has since Jan. 1, there would be indicated roughly a decrease of about $28,000,000 in net profits for the year.

The accompanying charts throw some light on the situation from the statistical angle. Stocks in refineries in North and South America reflect with fair accuracy fluctuations in the total supply of finished metal in the hands of producers. Each quarter since the second in 1926 has shown a moderate increase. The chart shows that these stocks are less than one-third what they were in 1919; they are equal to less than forty-five days' average current consumption by the United States. However, it is not the size but the *trend* in the size of stocks that influences the market, and the trend has not been favorable from the standpoint of the miner.

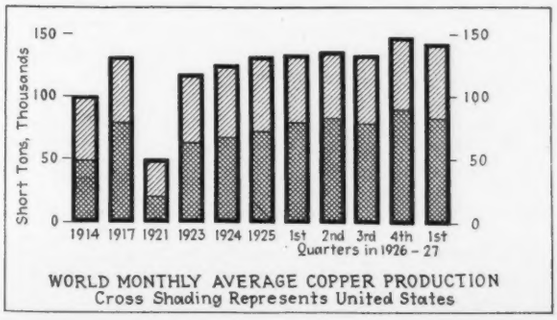
Shrinkage in consumption by Europe, particularly by Germany and Great Britain, was an important factor in the increase in stocks. The average monthly net imports by Germany declined from 16,000 tons in 1925 to 10,000 in 1926, and in Great Britain from 11,250 tons to 8,500, with the months in the last quarter lower than the average for the



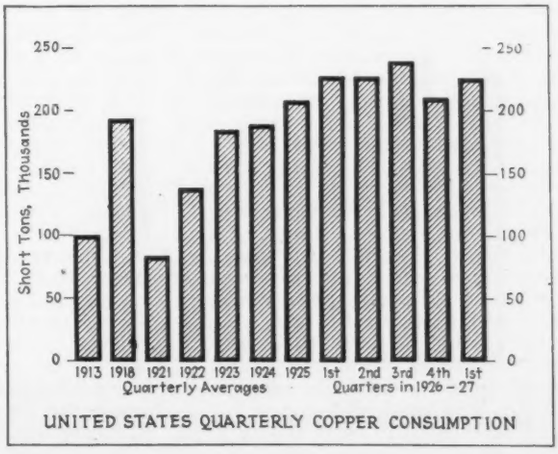
NET AVERAGE MONTHLY IMPORTS OF COPPER BY FOREIGN COUNTRIES

year. Reports are to the effect that buying by Germany has been satisfactory thus far this year, and that the other European countries have bought in good volume. On the other hand, some authorities see in the Chinese situation an influence that may affect European industrial activity adversely. Presumably the theory is that the generation of widespread pessimism will be reflected in curtailed activity.

Consumption in the United States was record breaking in 1926. The tapering in the last quarter is in part a seasonal phenomenon, but, even so, the shipments exceeded the average for 1925. The figures for the initial quarter of 1927 almost equal those of the corresponding period in 1926. The outlook for the second quarter is rather uncertain.



WORLD MONTHLY AVERAGE COPPER PRODUCTION
Cross Shading Represents United States



UNITED STATES QUARTERLY COPPER CONSUMPTION

Domestic buying in March was extremely dull. Even when taken in conjunction with record-breaking purchases in February, the average is lower than "normal," which suggests a decline in deliveries for April and May. This is by no means conclusive, however.

A brief survey of the outlook for the large copper-consuming industries shows: (a) Although the first quarter was dull for manufacturers of electrical equipment and machinery, the programs for expansion by central station plants are more extensive than ever before and the outlook is considered good. (b) The latest budget of the American Telephone & Telegraph Co. provides the largest appropriations in history for extension of plant and lines. (c) Contracts let in March for building and construction projects were the highest for any month on record, though this is partly accounted for by the two relatively slack months just preceding. (d) Automobile manufacturing, after a bad slump at the close of 1926 and a doubtful start for the present year, is looking better, although authorities are inclined to foresee a smaller total volume of output for 1927 than for 1926. All told, a fair forecast seems to be that if domestic consumption of copper does not equal or exceed that of 1926, at least it will not fall far short of that record-breaking figure.

Turning to production, the one element in the equation over which producers have entire control, the upward trend as disclosed by the accompanying chart is unmistakable, although the tall block for the last quarter of 1926 injects an irregularity into the picture. It is significant that production in the United States itself seems to govern the course of world production. All during 1926 and in the first quarter of 1927 foreign output has been almost uniform. The big increase in the fourth quarter came from the United States; likewise the curtailment in the subsequent quarter evidently was accomplished entirely by domestic producers. When all is said and done the crux of the copper situation is the rate of production.

March statistics, just issued, probably afford more room for optimism than do the exhibits on page 707. The estimated world rate of production in March was 7 per cent below that of February and 4.5 per cent below January. Corresponding figures for the United States are 10 and 9 per cent. As to stocks, not only did the figure for refined metal decline from 105,000 to 102,600 tons (as appears on the chart), but blister declined from 272,200 to 260,200 tons. Curtailment is an ever-recurrent subject of consideration by producers; less frequently it is a matter of accomplishment. In this particular instance something more than rumors and reports have eventuated, and unless the curtailment is short-lived a healthy influence on copper prices should be the result.

The widespread sentiment that, following a quarter of hesitation and caution, manufacturers and industrialists are generally more confident and optimistic, warrants the expectation of satisfactory activity during the remainder of the year. This, in conjunction with reasonable restriction in production programs—if it is adhered to—makes the copper outlook far from discouraging.

Sharpe Sees Chinese Situation as Important Influence in Zinc Market

The year 1927 opened with encouraging prospects for the zinc industry, but clouds soon appeared on the bright horizon owing to the far-reaching effects of the disturbances in southern China, says A. J. M. Sharpe, honorary correspondent of the American Zinc Institute. The success, so far, of the extremists in that country has been one of the principal factors for the slowing down of industrial progress in Europe, which is all the more disappointing because trade was gradually improving on the Continent following the economic setback in Germany last year and the industrial revival in Great Britain following the settlement of a prolonged coal strike.

With the London market the keynote of metal prices throughout the world, the retrogression in selling prices has been immediately reflected everywhere, and non-ferrous metals have failed to dissociate themselves from the general weakness apparent in the principal commodity markets.

How long it will be before the Chinese situation is restored it is impossible to forecast. Some of the Eastern merchant houses are of opinion that the success of the Cantonese forces will, in the long run, result in the establishment of a real government in China much quicker than would have been the case in the internecine warfare under which that country has suffered for some years. This school of thought avers that the Chinese as a whole are too sensible a nation to cling to Bolshevistic doctrines, and urge that the Cantonese leaders are merely using them as a means to an end. But there are other Eastern traders who are distinctly pessimistic and believe that it will take many years for China to emerge from the miasmic atmosphere in which it is involved today.

The substantially lower selling price of zinc today is not due to any unfavorable developments in the statistical position of the metal. It is true that there has been overproduction in the United States in the last few months. Indeed, it is essential in the interests of the United States zinc industry that the production of metal should be restricted within the limits of domestic consumption, as there will be no opportunity to export other than high-grade (99.9 per cent) metal except in abnormal times. Thanks to the response made by many countries to the call of Europe for increased quantities of ore, the supply has grown until today zinc ore is offered to even greater extent than smelters in the Old World require. That this is a fact is evidenced by the withdrawal of many smelters from the market entirely, while others have raised "returning" charges much above the rate ruling eighteen months ago. At the moment I do not think a period contract for good class concentrates, averaging not less than 45 per cent zinc, could be placed on a better basis than a returning charge of between 75s. and 80s. per metric ton, with payment in full for zinc contents over 8 units, on London prices ruling at arrival dates and with delivery c.i.f. Antwerp or Hamburg at buyer's option.

Consumption of metal in Europe during the first quarter of this year will compare favorably with any quarter in 1926, and there are hopes of better things. For instance, British galvanizers are not as busy as they might be, and when India starts to buy on a larger scale the activity of that important section of the zinc trade will become greater. On the Continent the position is regulated by the occupation of the rolling mills, and it is satisfactory to chronicle that those works have orders for zinc sheets on hand which will keep them going for some weeks to come. The prospects for building and construction in the present year are bright, so that the rollers are not without expectations that they will be kept reasonably busy throughout the year.

Though the statistical position of zinc is good, no great encouragment is forthcoming, as to the outlook for the market, and the price will in all likelihood continue to fluctuate in sympathy with the market movements of the other non-ferrous metals, and particularly with lead.

Mr. Sharpe estimates world stocks of zinc as of April 1, 1927, as 52,900 metric tons compared with 50,800 a month ago. Details follow:

United States	33,000
Canada	3,000
Australia (including unsold shipments afloat)	2,500
Germany-Poland	6,800
Belgium	3,000
France	1,200
Great Britain	1,200
Scandinavia	200
Far East	500
Elsewhere	1,500
Total	52,900

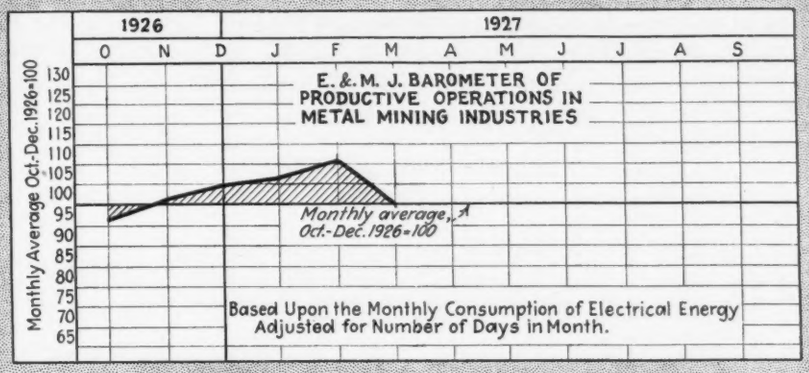
New York & Honduras Rosario Mining Co., producing silver and gold in Honduras, reports net profits of $375,709 for the year 1926. This compares with $480,709 in the preceding year. The decline in the market price for silver cut into earnings. Following are the comparative financial returns for the last two years:

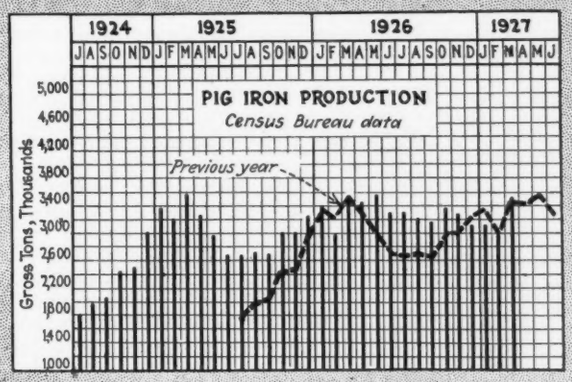
	1926	1925
Operating income	$1,537,422	$1,697,847
Net after expense	615,385	740,720
Total income	744,166	831,411
Net after taxes and deletion	$375,709	$480,709

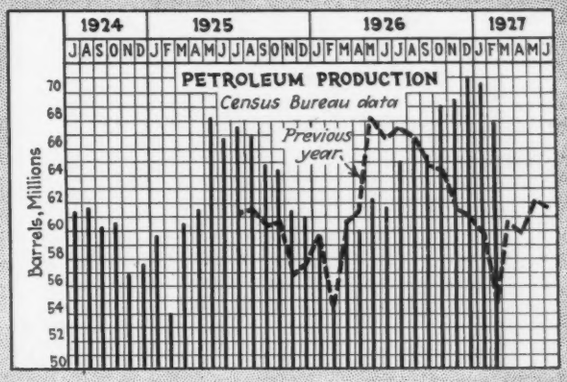
Dome Mines, Ltd., operating in the Porcupine district in Ontario, reports gold production in March as $324,263, against $314,910 in February and $344,933 in March a year ago.

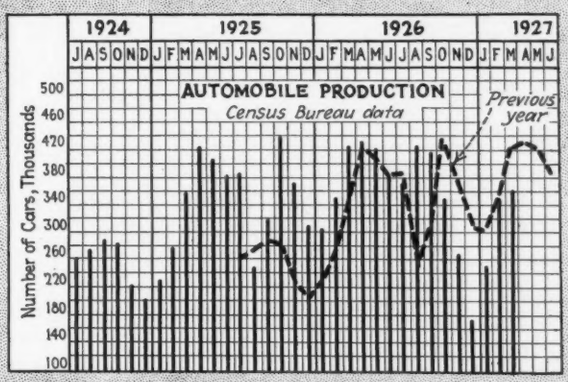
Indicators of Industrial Activity

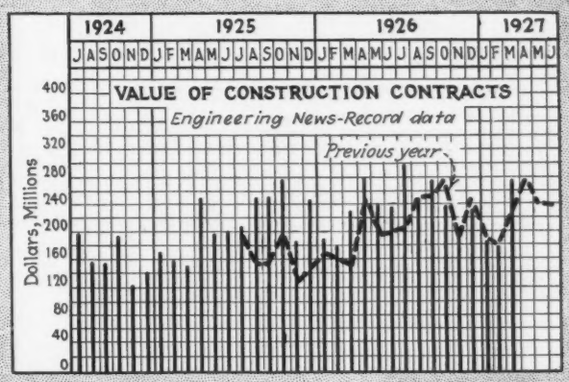
of Significance to Mining

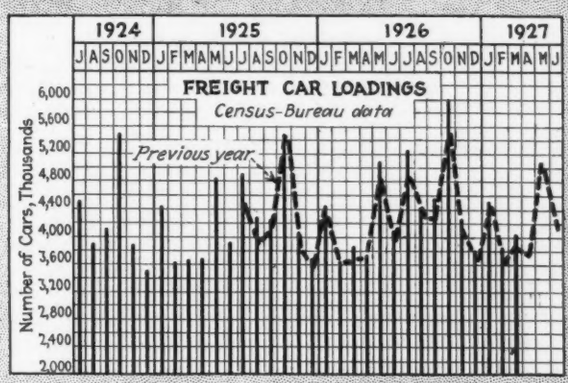

1926
1927
O N D J F M A M J J A S
E. & M. J. BAROMETER OF PRODUCTIVE OPERATIONS IN METAL MINING INDUSTRIES
Monthly Average Oct.-Dec. 1926-100
130 125 120 115 110 105 100 95 90 85 80 75 70 65
Monthly average, Oct.-Dec. 1926=100
Based Upon the Monthly Consumption of Electrical Energy Adjusted for Number of Days in Month.

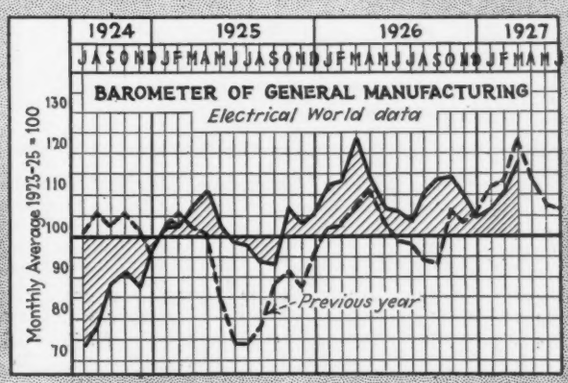

1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
PIG IRON PRODUCTION
Census Bureau data
Previous year
Gross Tons, Thousands
5,000 4,600 4,200 3,800 3,400 3,000 2,600 2,200 1,800 1,400 1,000


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
PETROLEUM PRODUCTION
Census Bureau data
Previous year
Barrels, Millions
70 68 66 64 62 60 58 56 54 52 50


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
AUTOMOBILE PRODUCTION
Census Bureau data
Previous year
Number of Cars, Thousands
500 460 420 380 340 300 260 220 180 140 100


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
VALUE OF CONSTRUCTION CONTRACTS
Engineering News-Record data
Previous year
Dollars, Millions
400 360 320 280 240 200 160 120 80 40 0


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
FREIGHT CAR LOADINGS
Census-Bureau data
Previous year
Number of Cars, Thousands
6,000 5,600 5,200 4,800 4,400 4,000 3,600 3,200 2,800 2,400 2,000


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
BAROMETER OF GENERAL MANUFACTURING
Electrical World data
Monthly Average 1923-25 = 100
130 120 110 100 90 80 70
Previous year

The Market Report

Copper Market Comes to Life

Price Established at 13 1/8c.—Lead and Zinc Quiet and Easier

New York, April 20, 1927—The feature of the week in the non-ferrous metal markets has been the large volume of copper buying after seven weeks of unusual dullness. Today the price seems to be fairly well established at 13⅛c., delivered in Connecticut. Business in the other metals was only moderate and prices for lead and zinc are lower than a week ago. Antimony is quiet but firm, tin is quiet and steady, and quicksilver is dull and easier. A further reduction in the price of platinum was made during the week, the market for all of the platinum group of metals being stagnant.

Copper Sales Exceptionally Heavy

The issuance of March copper statistics showing a decidedly improved position in respect to stocks and current production started a buying wave last Wednesday that has continued for five business days. The total volume of sales has been greater than the aggregate of the four preceding weekly periods, and was exceeded by only one week since the first of the year. Deliveries have been specified principally for May and June, with a lesser quantity for prompt, and some as far ahead as July. In spite of the activity it seems improbable, however, that the "slack" created in the last seven weeks has been taken up, and sellers look for further buying in reasonable volume. Most of the Eastern business was placed at 13c. until Monday, when all but two or three sellers increased their price to 13¼c. A little 13c. metal hung over until yesterday, but today 13⅛c. appears to be the bottom, and some are talking of even higher prices. Foreign business has likewise been good, and effective today the price of the export association has been increased to 13.50c. c.i.f., the former figure being 13.35c. The f.a.s. market is quiet at about 13.25c. Domestic buying today has been quiet, but a breathing spell is to be expected. One large consumer takes the attitude that he can afford to wait now until he sees whether the curtailment in output shown by the March figures will persist in April.

Daily Prices of Metals

April	Copper	Tin		Lead		Zinc
	Electrolytic, N. Y.	99 Per Cent	Straits	N Y.	St. L	St. L
14	12.775	66.625	68.00	7.25	6.90@6.925	6.35@6.40
15	12.775	66.625	68.125	7.20@7.25	6.90	6.375
16	12.775@12.80	66.875	68.375	7.20@7.25	6.90	6.35@6.375
18	12.775@12.80	66.375	68.50	7.15	6.85@6.875	6.35
19	12.825@12.925	66.625	68.625	7.15	6.80	6.35@6.375
20	12.90	65.875	68.00	7.00	6.65@6.775	6.30@6.325
	12.817	66.500	68.271	7.167	6.848	6.356

Average prices for calendar week ending April 16, 1927, are: Copper, 12.777c.; 99 per cent tin, 66.654c.; Straits, 68.042c.; N. Y. lead, 7.242c.; St. L. lead, 6.923c.; zinc, 6.381c.; and silver, 56.417c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis: i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per pound is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

April	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
14	55¼	55⅞	61¼	305¼	298½	27¼	27 11/16	29⅞	30 3/16
15	Holiday	...	...	....	....	....	....	....	....
18	Holiday	...	...	....	....	....	....	....	....
19	55¾	56¼	61¼	306	299½	26⅞	27 5/16	30⅛	30⅜
20	55½	56⅛	62	302¼	297¼	26¾	27 3/16	29⅞	30 3/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Apr.	Sterling Exchange "Checks"	Silver		Gold London	Apr.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
14	4.85⅛	56¼	26	84s11½d	18	4.85⅛	56⅞	Holiday	.....
15	4.85⅛	56¼	Holiday	.....	19	4.85⅛	56⅝	26¼	84s11½d
16	4.85⅛	56¼	Holiday		20	4.85⅛	56½	26 5/16	84s10½d
					Avg.		56.458		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Lead Down to 7c., New York

Lead is indubitably weaker, and no one seems to be optimistic as to the price trend in the immediate future. Sales in the last week have been of fair volume, but current consumption is disappointing compared with last year and is almost certainly below the rate of production. Production, incidentally, shows no signs of declining in the March statistics, and without such curtailment there can be little hope of better prices. Mexican production, which it was supposed had been cut, actually showed a substantial gain.

On Monday, April 18, the American Smelting & Refining Co. reduced its contract price for New York lead from 7.25 to 7.15c. Reductions were also made by sellers in the Middle West from 6.90c., St. Louis basis, to 6.80c. Even at the reduced levels few buyers could be found, battery makers continuing out of the market. A little interest was shown by paint manufacturers, who report a good though seasonal improvement in their business; two or three days ago, for example, a fair sized order for corroding lead was placed at 7.05c., Chicago basis. Late this afternoon, a further reduction was made by the Smelting company to 7c., New York, practically no business having been done at the higher level.

Zinc Continues Quiet

With no apparent curtailment in mine output in Joplin, and a reduction in the ore price to $42 a ton, Prime Western zinc has eased during the week in a quiet market. Galvanizers are still backward buyers and today metal is available at from 6.30c. to 6.325c. High-grade is quoted at 8.25c. delivered in New York and continues dull.

Tin Drops After Quiet Week

The Easter holidays in London have interfered with the tin market, with the

result that until today prices showed little change, though sellers were firm. The marked drop in London today was rather unexpected in view of the rather strong tone here; it brought New York prices for prompt Straits to the neighborhood of 68c., with forward tin about 1¼c. less.

Silver Closes at 56½c.

During the first half of the week, the silver market remained dull, with quotations unchanged at 56¼c. on account of the Easter holidays abroad. The price, however, rose sharply on April 18 to 56⅞c., probably due to operations in silver against yen in connection with the financial uncertainties in Japan. Quotations have since eased off slightly to 56¼c., and the market closes quiet, with an uncertain tendency.

Mexican Dollars (Old Mexican pesos): April 14th, 15th, and 16th, 42⅜c.; 18th, 43¼c.; 19th, 43c.; 20th, 42⅛c.

Italian Lire Advance

Closing cable quotations on Tuesday, April 19th, of various foreign exchanges were: Italian lire, 5.00c., a net increase of 0.13c. from the preceding week; francs, 3.91⅜c.; and marks, 23.70½c. Canadian dollars, 7/32 per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

Aluminum—Per lb., 98 or 99 per cent grade, price of leading interest, 26c.; outside market, 25.30@25.80c. London, 98 per cent, £105@£107 per long ton for domestic consumption.

Antimony—Per lb., duty paid, New York: Chinese brands, spot business at 15⅛@15¼c.; June arrival about ⅛c. higher; Cookson's "C" grade, spot, 18c. Market dull. Needle antimony nominally 8c. for lump and 10c. for powdered. White oxide, 16½c.

Bismuth—Per lb., New York, in ton lots, $2.20@$2.25. London, 8s.

Cadmium—Per lb., New York, 60c. London, Australian metal selling freely at 1s. 10d.

Iridium—Per oz., $115@$120 for 98@99 per cent sponge and powder.

Nickel — Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade). London, £170@£175 per long ton, according to quantity.

Palladium—Per oz., $58@$61. Small lots bring up to $67. Pure metal as a constituent of crude platinum, $55@$58 per oz. London, £11@£12, nominal.

Platinum — Official price quoted by the leading interest on miscellaneous orders for refined metal, $102. Price cut from $104 on April 14. Open market cash sales of large lots, in New York, $94@$96. Pure metal as a constituent of crude platinum, $93@$94. Market remains dull.

London, £20⅞@£21 per oz. for refined and £18½@£19½ for crude. Dull.

Quicksilver—Per 75-lb. flask, $122@$124. Quiet. Good demand in Europe and China. San Francisco wires $120.67. London, £20½.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of April 9.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn, 35@37c. Caucasian (washed), 53@55 per cent, 37@39c. Business dull. Chemical grades unchanged from quotations in the April 9 issue.

Tungsten Ore — Per unit of WO₃, N. Y.: Wolframite, $10.50@$10.75; Western scheelite, $11@$11.25. Dull; prices largely nominal.

Chrome, Iron, Molybdenum, Tantalum, Titanium, Uranium, and Vanadium Ores are unchanged from quotations in the April 9 issue. Prices for Lake Superior iron ores have been reaffirmed for the current season.

Unchanged Prices on Zinc Blende and Lead Ore

Joplin, Mo., April 16, 1927

Blende	
High	$46.00
Premium blende, basis 60 per cent zinc	$43.00@ 44.00
Prime Western, basis 60 per cent zinc	42.00
Fines and slimes, 60 per cent zinc	41.00@ 38.00
Average settling price, all zinc	42.30
Galena	
High	$96.20
Basis 80 per cent lead	92.50
Average settling price, all lead	93.99

Shipments for the week: Blende, 11,784; lead, 1,985 tons. Value, all ores the week, $683,070.

The production this week was approximately 15,000 tons, of which 13,000 tons were sold today for next week's delivery, adding 2,000 tons to a reserve stock being held by companies that will not accept current prices. A number have closed the mills to mine production and are operating them reconcentrating tailing. Of the total of 148 mills in operation 32 are on tailing and producing about 1,400 tons per week.

Lead shipment was lowered more than 500 tons from the previous week and was the smallest since Feb. 19. Stocks in bins are estimated at 9,000 tons, held by companies that sell only when the price justifies.

Platteville, Wis., April 16, 1927

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$44.75
Lead Ore	
Lead, basis 80 per cent lead	$95.00

Shipments for the week: Blende, 1,350 tons; lead, 80 tons. Shipment for the year: Blende, 19,823; lead, 520 tons. Shipments for the week to separating plants, 2,907 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fullers Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the April 9 issue.

Mineral Products

Arsenious Oxide (White Arsenic)—3⅞c. per lb. Quiet.

Calcium Molybdate, Copper Sulphate. Sodium Nitrate, Sodium Sulphate (Salt Cake), and Zinc Oxide are unchanged from prices in the April 9 issue.

Ferro-Alloys

Ferrochrome—Per lb. of contained chromium, 60@70 per cent chromium, 4@6 per cent carbon, 11½c.

Ferromanganese—Domestic and foreign, 78@82 per cent, $100 per long ton, furnace or duty paid, for delivery during first half of 1927. Spiegeleisen, 19@21 per cent, $37, f.o.b. furnace; 16@19 per cent, $34; nominal.

Ferrotungsten—$0.98@$1.03 per lb. of W contained, f.o.b. works. Market spotty.

Ferrocerium, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferro-uranium and Ferrovanadium are unchanged from prices in the April 9 issue.

Metal Products

Rolled Copper—Sheets, 21⅜c.; wire, 15c. f.o.b. mill.

Lead Sheets—Full rolled, 11c. per lb.; clipped, 11½c.

Nickel Silver—28⅜c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal—Dimension sheets, 19½c. per lb.; rods, 16½c.

Zinc Sheets—10½c. per lb., f.o.b. mill. Cut from 11c. on April 15.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the April 9 issue.

Steel Market Reflects Seasonal Trend

Prices a Shade Easier—Pig Iron Dull—Coke Offerings Increase

Pittsburgh, April 18, 1927

The volume of steel buying continues to diminish, though at a slow pace. Orders in the last week have totaled materially less than the rate in March. No change in general underlying conditions is indicated, the trend being apparently seasonal.

Pig Iron.—The Valley market continues dull, quite in keeping with experience in other districts. Bessemer is quoted at $19.50; basic, $19, and foundry, $18.50, f.o.b. Valley furnaces.

Connellsville Coke.—There has thus far been no striking in the Connellsville coke region, in connection with the union bituminous coal strike, but more or less striking is expected in time. The spot market is softer, offerings being larger, in face of light demand, and production is somewhat curtailed. Spot furnace is quoted at $3.25, and spot foundry at $4.25@$4.75.

Mining Stocks—Week Ended April 16, 1927

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	47⅞	46½	47	Ap.16,May21	Q 0.75
Arcadian Consol.	Boston	*41	*41	*41		
Ariz. Com'l	Boston	6⅞	6½	6⅝	Ja. 7, Ja. 28	0.50
Calaveras	N. Y. Curb	2 1/16	2	2⅛		
Calumet & Arizona	New York	67	67	67	Ma. 5, Ma. 21	Q 1.50
Calumet & Hecla	Boston	16½	15½	16½	My.31, Jn.15	Q 0.50
Cerro de Pasco	New York	62⅛	61	61⅛	Ap. 14, My.2	Q 1.00
Chile Copper	New York	37½	36⅛	37⅛	Ma.4,Apr.1,	Q 0.62½
Con. Coppermines	N. Y. Curb	3	3	3		
Copper Range	Boston	12⅞	12⅛	12⅛	Ap.2, My 2,	A 1.00
Crystal Copper	Boston Curb	*27	*26	*26		
East Butte	Boston	2	2	2	Dec., 1919	0.50
Granby Consol.	New York	35½	34⅜	35	May, 1919	1.25
Greene-Cananea	New York	40	36½	39⅛	Nov., 1920	0.50
Hancock	Boston	*50	*50	*50		
Howe Sound	New York	39⅛	38	39⅛	Apr.1,Apr.15	Q 1.00
Inspiration Consl.	New York	19⅛	18⅛	18⅛	Ma.17, Ap.4,	Q 0.25
Iron Cap	Boston Curb	2⅛	1⅞	2		
Isle Royale	Boston	10⅛	10⅛	10⅛	Fe.4, Fe.19	Q 0.50
Kennecott	New York	63⅛	62⅛	63⅞	Mar. 4 Apr. 1	Q 1.25
Magma Copper	New York	35	34⅛	34⅛	Ma.31,Ap.15,	Q 0.75
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Miami Copper	New York	15⅞	15⅛	15⅛	My.2,My.16	Q 0.37½
Mohawk	Boston	39⅜	39	39⅛	Ap.30, Jn.1	Q 1.00
Mother Lode Coa.	New York	4⅛	4⅛	4⅛	De.10, De.31	SA 0.37½
Nevada Consol.	New York	14⅛	14⅛	14⅜	Ma.17,Ma 31	Q 0.37½
New Cornelia	Boston	22⅛	22⅛	22⅛	My.6, My.21	Q 0.50
Noranda	N. Y. Curb	21⅛	20⅛	21		
North Butte	Boston	2	1⅞	2	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*43	*43	*43	Sept., 1926	0.03
Old Dominion	Boston	13⅛	13⅛	13⅛	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†126	†121		Ma.22, Apr.2	Q 1.50
Quincy	Boston	16⅛	16⅛	16⅛	Mar., 1926	1.00
Ray Consolidated	New York	15	15	15	Ap.20, Ap 30	0.25
St. Mary's Min. Ld.	Boston	22	21⅛	21⅛	Fe.10 Ma.10	2.00
Seneca Copper	New York	2⅛	2⅛	2⅛		
Shattuck-Denn	Boston Curb	4⅞	4⅜	4⅜		
Tenn. C. & C.	New York	11⅛	11	11⅛	Fe.28, Ma.15,	Q 0.25
United Verde Ex.	N. Y. Curb	25⅛	25	25	Apr.6, May1	Q 0.75
Utah Copper	New York			112	Ma.17,Ma.31	Q 1.50
Utah Metal & T.	Boston	1⅜	1⅛	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	*61	*55	*61		
NICKEL-COPPER						
Internat. Nickel	New York	54⅛	48	52	Ma.17,Ma.31	Q 0.50
Internat. Nickel, pfd.	New York			105	Ap.14,My.2	Q 1.50
LEAD						
Gladstone Mtn.	Spokane	*27½	*26	*26	March, 1927	0.005
National Lead	New York	196⅛	189	193	Ma.11,Ma.31	Q 2.00
National Lead pfd.	New York	127	125	125	March, 1927	Q 1.75
St. Joseph Lead	New York	40⅞	40½	40⅝	Se.10,Se.20,	QX 0.75
ZINC						
Am. Z. L. & S.	New York	8⅛	8⅛	8⅛	May, 1917	1.00
Am. Z. L. & S, pfd.	New York	48⅛	47⅛	47⅛	Nov., 1920	1.50
Butte C. & Z.	New York	3⅞	3⅛	3⅛	De.9, De.24	0.50
Butte & Superior	New York	9⅛	9	9	Ma.15, Ma.31	Q 0.50
Callahan Zn-Ld	New York	1⅞	1⅞	1⅞	Dec., 1920	0.50
Consol. Lead&Zinc'A'	St. Louis	14⅛	13	14⅛	Ma.15, Ap.1	Q 0.25
Eagle-Picher	Cincinnati	28	27	27⅞	Au.15, Se.1	Q 0.40
Eagle-Picher, pfd.	Cincinnati	116	116	116	Jn.30, Jy.15	Q 1.50
New Jersey Zn.	N. Y. Curb	190	189	189	Ja.20, Fe.10	Q 2.00
United Zinc	N. Y. Curb			55		
Yellow Pine	Los Angeles	*25	*25	*25	Dec. 1925	Q 0.04
GOLD						
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Argonaut	Toronto	*43	*40	*42		
Barry-Hollinger	Toronto	*42	*40	*40		
Carson Hill	Boston			*50		
Consol. W. Dome L.	Toronto	*7⅛	*7⅛	*7⅛		
Cresson Consol. G.	N. Y. Curb	2⅛	2	2	Ma.31,Ap.10	Q 0.10
Dome Mines	New York	8⅛	8⅛	8⅛	Ap.18, My5.	Q 0.25
Golden Cycle	Colo. Springs	†1.65	†1.60		Fe.28,Ma. 10	Q 0.04
Hollinger Consol.	Toronto	20.80	20.68	20 70	Ap.6, Ap.20	0.10
Homestake Mining	New York	62	61⅛	62	Ap.20,Ap.25	M 0.50
Kirkland Lake	Toronto	1.21	1.06	1.20		
Lake Shore	Toronto	19.45	18.55	19.40	Ma.1, Ma.15	0.10
McIntyre-Porcupine	New York	25	24⅛	25	My.2, Jn.1	Q 0.25
Portland	Colo Springs	†*50	†*45		Ap.6, Ap.15,	Q 0.02
Rand Mines	New York			9⅛	Au.23-30	Am .Sh. 1.52
Teck-Hughes	Toronto	7.02	6.79	6.98	Ja.31, Fe. 1	0.05
Tom Reed	Los Angeles	*50	*50	*50	Dec., 1926	0.02
Tough-Oakes	Toronto	*52½	*48	*49½		
United Eastern	N. Y. Curb			*44	July, 1924	0.05
Vipond Cons.	Toronto	1.45	1.42	1.43	Apr.1 Apr.15	0.03
Wright-Hargreaves	Toronto	11.00	10.60	10.95	Ap.15,My.2	0.10
GOLD AND SILVER						
Carnegie Metals	Pittsburgh	*13½	*13	*13		
Con. Cortes	N. Y. Curb	*23	*20	*22		
Con. Virginia	San Francisco	*4½	*4½	*4½		
Dolores Esperansa	N. Y. Curb			*35	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅛	2 1/16	2 1/16	Ma.15, Ap.4	Q 0.08
Tonopah Belmont	N. Y. Curb	1⅛	1 1/16	1 1/16	Ma.15, Ap.4	0.08
Tonopah Extension	N. Y. Curb			*32	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	2⅛	2⅛	2⅛	Ma.31, Apr.21	0.07½
West End Consol.	N. Y. Curb	*10	*10	*10	Mar., 1923	0.05
Yukon Gold	N. Y. Curb			*45	June, 1918	0.02
SILVER						
Beaver Consol.	Toronto	*86	*76½	*85½	May. 1926	0.03
Canadian Lorrain	Toronto	*36	*22	*23		
Castle-Trethewey	Toronto	1.01	*98½	*98½		
Coniagas	Toronto	3.75	3.70	3.70	May, 1924	0.12½
Keeley	Toronto	1.45	1.41	1.43	Fe.28, Ma.15	X 0.12
Lorrain Trout Lake	Toronto			*35	July, 1925	0.05
McKinley-Dar.-Sav.	Toronto	*15½	*13½	*15½	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.66	3.45	3.58	De.30, Ja.15	0.12½
Nipissing	N. Y. Curb	8⅛	7⅜	7⅜	Ma.31, Ap.20	Q 0.15
SILVER-LEAD						
Ahumada	New York	4⅛	4⅛	4⅛	Ma.25,Ap.4,	QX 0.12½
Bingham Mines	Boston	47⅛	42⅛	47	Ma.21, Ap.5	Q 1.00
Bunker Hill&Sullivan	N. Y. Curb	75⅛	74⅛	75⅛	Ma.31,Ap.4	MX 0.50
Cardiff M. & M.	Salt Lake	*54	*42	*54	Feb. 5, 1927	0.10
Chief Consol.	Salt Lake	2.55	2.55	2.55	Oc.10, No.1	Q 0.10
Consti'n Mng.&Mill'g	Spokane	*31	*26	*26		
Erupcion	Boston Curb	*65	*60	*63	Ma.25, Ap,2	Q 0.07½
Eureka Lily	Salt Lake	1.47½	1.35	1.40		
Federal M. & S.	New York	114	114	114		
Federal M. & S., pfd.	New York	95	94	94⅛	Fe.24, Ma.15	Q 1.75
Hawthorne Mines	N. Y. Curb	*4	*4	*4		
Hecla Mining	N. Y. Curb	14⅛	13⅛	13⅛	Fe.15,Ma.15	Q 0.25
Highland-Surprise	Spokane	*9½	*9	*9½		
Iron King Mining	Salt Lake	*41	*39	*39		
Keystone Mining	Salt Lake			*32	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*20	*19½	*19½		
Lucky Tiger-Com.	Kansas City	†7.00	†6 62½		Ap.20, 1927	M 0.05
Mammoth Mining	Salt Lake	2.15	2.00	2.15	De.17, De.23,	Q 0.25
Marsh Mines	Spokane	2⅛	2	2		
North Lily	Salt Lake	3.05	3.00	3.00		
Park Utah	New York	7⅛	6⅞	6⅞	Ma.15, Ap.1	Q 0.20
Plutus Mining	Salt Lake			2.00	Ja.10, Ja.15	Q 0.10
San Rafael	San Francisco			*24		
Silver King Coal.	Salt Lake	7.90	7.75	7.90	Ma.21, Ap.1	Q 0.25
Silversmith	Spokane	*34	*33	*33	Oc.1, Oc.10	Q 0.02
Strattons Mines	Spokane	*46	*45	*45½		
Sunshine M. Co.	Spokane	*58	*56	*58		
Tamarack-Custer	Spokane	*31½	*29	*31	Sept., 1924	0.25
Tintic Standard	Salt Lake	11.00	10.75	10.75	Ma.16, Ma.29	X 0.40
Utah-Apex	Boston	6⅛	5⅞	6⅛	Oct., 1926	0.25
IRON						
Bethlehem Steel	New York	56⅞	53⅛	53⅛	July, 1924	1.25
Butler Bros	Chicago	22⅛	22	22⅛	Ja. 29, Fe. 15	Q 0.625
Cleveland-Cliffs Iron	Cleveland	80	77	78	Ja.15, Ja.25	Q 1.00
Colorado Fuel & Iron	New York	79⅛	70⅛	77⅛	May, 1921	0.75
Gt. North'n Iron Ore	New York	20⅛	19⅛	20⅛	Dec.6, Dec.28	0.75
Inland Steel	New York	44⅞	42⅞	44⅞	Fe.15, Ma.1	Q 0.62½
Replogle Steel	New York	10⅜	10⅛	10⅛		
Republic I. & S.	New York	72⅛	70⅛	72	Fe.15,Ma. 1	Q 1.0
Republic I. & S. pfd.	New York	104⅛	104⅛	104⅛	Ma.15, Ap.1	Q 1.75
Sloss-Sheffield S. & I.	New York	133⅛	129⅛	133⅛	Ma.10, Ma.21	Q 1.50
Sloss-Shef. S.&I. pfd.	New York	108⅛	107	108⅛	Ma.21, Ap.1	Q 1.75
U. S. Steel	New York	172⅞	170	172	Fe.28,Ma.30	Q 1.75
U. S. Steel pfd	New York	124⅞	123	124⅛	Ja.29, Fe.26,	Q 1.75
Virginia I. C. & C.	New York			44	Jan., 1924	1.50
Virginia I.C.&C.pfd.	New York			60⅛	De.15, Ja.2,	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol.	New York	31⅞	31⅛	31⅛	Ja.26, Ja.29	1.45
So. Am. Gold & P.	N. Y. Curb	3⅜	3⅛	3⅛		
Alum.Co.of Amer.	N.Y.Curb			68		
Alum. Co. of Amerpf.	N.Y.Curb	104⅛	104	104⅛	Ma.15,Ap.1	Q 1.50
Vanadium Corp.	New York	50⅛	48	48⅜	Fe.1, Fe.15,	Q 0.75
Patino M. & E.	New York	25	22⅛	24⅛	Ap.27, My.5	1 sh.
ASBESTOS						
Asbestos Corp.	Montreal	23	22⅛	22⅛	Jan., 1926	1.50
Asbestos Corp., pfd.	Montreal	88⅛	87	88	Ma.31,Ap.15	Q 1.75
SULPHUR						
Freeport Texas	New York	74⅛	63⅛	67⅛	Ap.15, Ma.2	Q 1.00
Texas Gulf, new	New York	64⅛	61⅛	62	Ma.1, Ma.15	Q 1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	41⅞	40⅞	41⅞	Fe.18, Ma. 1	Q 0.75
Amer. Metal pfd.	New York			110⅛	Fe.19, Ma.1	Q 1.75
Amer. Sm. & Ref.	New York	150⅞	147	148	Ap.14, My.2	Q 2.00
Amer. Sm.&Ref.pfd.	New York	122⅛	122	122⅛	My.6, Jn.1	Q 1.75
Consol. M. & S.	Montreal	263⅛	258	259	De.31, Ja.15	X 6.25
Federated Metals	N. Y. Curb			13		
Newmont Mining	N. Y. Curb	79	73⅛	74	Ma.31,Ap.15	Q 0.60
U. S. Sm. R. & M.	New York	38⅛	37⅛	38⅛	Ap.7 Ap.15	Q 0.87½
U. S. Sm. R.&M.pfd.	New York	48⅛	47⅞	47⅞	Ap.7, Ap. 15,	Q 0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.: Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.: Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED APRIL 5, 1927

Name	High	Low	Last	Date	Last Div. Amount
Aramayo Mines (25 frs.)	86/10½	84/4½	85/—	Feb. 1927	5 (†)
British Platinum (£1)	4/4½	3/6	4/—	Feb. 1925	2½ p.c.
Burma Corpn. (10 rupees)	14/1½	13/7½	13/10½	Feb. 1927	6 annas*
Bwana M'Kubwa (5s)	6/6	5/9	6/3		
Camp Bird (2s)	4/9	4/6	4/9		
El Oro (£1)	4/7½	4/3	4/4½	Nov. 1924	2½ p.c.*
Esperanza (10s)	—/2	—/2	— 2		
Frontino & Bolivia (£1)	12/6	12/—	12/6	Jan. 1927	5 p.c.
Mexican Corpn. (£1)	9/3	9/—	9/3		
Mexico Mines of El Oro (£1)	16/3	15/7½	16/3	Dec. 1926	3½ p.c.*
N'Changa Copper Mining	12/4½	11/3	11/3		
Oroville Dredging (£1)	6/9	6/6	6/9	Dec. 1923	3½ p.c.
Ouro Preto (£1)	2/1½	2/—	2/—	May 1925	2½ p.c.
Rhodesian Congo Border (£1)	62/6	55 —	60 —		
St. John del Rey (£1)	12/7½	12/6	12/6	May 1927	3½ p.c.
San Francisco Mines (10s)	30/3	29/9	30/—	Jan. 1927	25s.
Santa Gertrudis (£1)	15/6	14/9	15/—	Jan. 1927	3½ p.c.
Selukwe (2s. 6d.)	11/—	10 —	10/6	April 1917	6¼ p.c.
S. Amer. Copper (2s.)	3/3	3/—	3/3	Nov. 1917	75 p.c.
Tanganyika (£1)	60/7½	50/—	51/3	Aug. 1926	7½ p.c.
Union Miniere du Haut-Katanga (Brussels)	9.350	9 250	9 335	July 1926	175 (‡)

* Free of British income tax. † Swiss frs. ‡ Belgian frs. and free of taxation.